FIVE-YEAR REVIEW REPORT FOR SAUGET AREA 2 SUPERFUND SITE ST. CLAIR COUNTY, ILLINOIS

Prepared by

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Date

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LIST OF ACRONYMS

2,4-D	2,4-dichlorophenoxyacetic acid
ABRTF	American Bottoms Regional Wastewater Treatment Facility
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BHC	Benzene hexachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	Chemical of potential concern
COPEC	Chemical of potential ecological concern
cm/sec	Centimeters per second
DHU	Deep Hydrogeologic Unit
DNAPL	Dense non-aqueous phase liquid
EPA	United States Environmental Protection Agency
FFS	Focused feasibility study
FYR	Five-Year Review
GMCS	Groundwater Migration and Control System
gpm	Gallons per minute
HDPE	High-density polyethylene
IAWC	Illinois American Water Company
ICs	Institutional Controls
Illinois EPA	Illinois Environmental Protection Agency
IFCMP	Illinois Fish Contaminant Monitoring Program
MCL	Maximum Contaminant Level
MCPP	Methyl-chlorophenoxy-propionic acid
MHU	Middle Hydrogeologic Unit
msl	Mean sea level
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polyaromatic hydrocarbon
PCB	Polychlorinated biphenyl
P-Chem	Physical/Chemical Treatment Plant
PCP	Pentachlorophenol
PDA	Plume discharge area
ppm	parts per million
ppb	parts per billion
PRP	Potentially Responsible Party
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
SHU	Shallow Hydrogeologic Unit
SVOC	Semi-volatile Organic Compound
TDS	Total dissolved solids
TOC	Total organic carbon
TRV	Toxicity Reference Values
ug/L	micrograms per liter (parts per billion)
UU/UE	Unlimited use/ unrestricted exposure

USACE	United States Army Corps of Engineers
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This is the second five-year review (FYR) for the Sauget Area 2 Superfund (Site) located in the Villages of Sauget and Cahokia, St. Clair County, Illinois. The purpose of this FYR is to determine if the interim remedy, selected by EPA in its September 2002 Record of Decision (ROD) for Operable Unit 2 (OU2), is protective of human health and the environment. This ROD presented an interim groundwater remedy to address the "release of contaminated groundwater into the Mississippi River at the Sauget Area 2 Site in the vicinity of disposal Site R". The physical construction of the remedial action began in 2003 and was completed in November 2005. The triggering action for this statutory FYR was the signing of the previous FYR on June 26, 2008.

The Site is located in an area historically used for heavy industry, including chemical manufacturing, metal refining, power generation and waste disposal. As a whole, the Sauget Area 2 Site consists of five inactive disposal areas which are referred to as Sites O, P, Q, R and S. Three of the sites are closed landfills (Sites P, Q and R); one consists of four closed sludge lagoons (Site O); and one is a waste disposal site associated with an abandoned solvent reclamation facility (Site S). For purposes of investigation and selection of necessary response actions, the Area 2 Site has been divided into two Operable Units (OUs). OU1 relates to the soil and groundwater source contamination within the Site's boundaries. A ROD has not been issued yet for OU1. OU2 addresses groundwater, in which an interim remedy to control contaminated groundwater is the focus of this FYR. In addition to OU1 and OU2, EPA will issue a separate ROD to address regional groundwater contamination from both the Sauget Area 1 and Sauget Area 2 Sites after remedies are chosen for the soil and groundwater contamination source areas at the Sites.

The purpose of the interim remedy for OU2 was to address the release of contaminated groundwater to the Mississippi River in the vicinity of Site R and the associated risks. Site R is an old chemical waste landfill located next to the River. A large groundwater plume also bisects the area around Site R, as it migrates towards the River. Several source areas contribute to the contamination in this plume, including but not limited to Sauget Area 2 Sites O, Q North (dog leg), and R; Sauget Area 1 Site I; the W.G. Krummrich plant, Clayton Chemical Facility and other industrial facilities in the Sauget area. The remedy consists of a 3,500 foot U-shaped barrier wall that is 140 feet deep and terminates in bedrock. It is equipped with a groundwater extraction system that is designed to collect groundwater migrating towards the River and transfer it to the American Bottoms Regional Treatment Facility (ABRTF) in the Village of Sauget, where it is treated prior to being discharged to the Mississippi River. Together, the barrier wall and the extraction wells are referred to as the Groundwater Migration and Control System (GMCS). Although the length of the barrier wall corresponds to the edge of Site R, other sources of contamination that are upgradient of Site R and that may be contributing to the contaminated groundwater being treated by the GMCS include Sauget Area 2 Sites O, Q North (dogleg), and S; Sauget Area 1 Site I; the W.G. Krummrich plant and the Clayton Chemical facility.

The interim remedial action selected for OU2 has several Remedial Action Objectives (RAOs). RAOs are general descriptions of the goals established for protecting human health and the environment, to be accomplished through remedial actions. RAOs normally identify the medium of concern, contaminant of potential concern, EPA acceptable risk levels, potential exposure routes, and potential receptors. Based on the risks associated with the release of impacted groundwater to surface water, the RAOs for the OU2 interim remedy include: protection of aquatic life in surface water and sediments from exposure to Site contaminants; prevention or

abatement of actual or potential exposure to nearby human populations (including workers), animals or the food chain from hazardous substances, pollutants or contaminants; prevention or abatement of actual or potential contamination of drinking water supplies and ecosystems; achievement of acceptable chemical-specific contaminant levels, or a range of levels, for all applicable exposure routes; mitigation or abatement of the release of contaminated groundwater in the plume area to the Mississippi River so that the impact is "insignificant" or "acceptable" as required by the May 3, 2000 W.G. Krummrich Resource Conservation and Recovery Act Administrative Order on Consent (EPA Docket No. R8H-5-00-003).

The barrier wall was constructed according to appropriate standards, as documented in the Remedial Action Completion Report (October 2009), and the GMCS is functioning to remove significant volumes of contaminated groundwater from the aquifer. Data collected during the past five year period demonstrates the OU2 interim remedy is operating as intended and making progress towards achieving the RAOs identified in the interim ROD. The GMCS is significantly reducing the discharge of contaminated groundwater into the Mississippi River as measured by the attainment of a zero or inward hydraulic gradient across the barrier wall and a 98 % reduction in the mass flux of contaminants to the River. The OU2 interim remedy is making progress towards achieving the RAOs by providing a record of groundwater, surface water and sediment data to help define and achieve site-specific protective concentrations. As mentioned, EPA will be issuing a separate final ROD addressing regional groundwater contamination from both the Sauget Area 1 and Sauget Area 2 Sites, as referenced above. The selected interim remedy for OU2 is expected to be protective of human health and the environment upon completion of and in conjunction with the final OU2 groundwater remedy.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Sauget Area 2		
EPA ID: ILD000605790		
Region: 5	**State:** IL	**City/County:** Sauget and Cahokia/ St. Clair County

SITE STATUS	
NPL Status: Proposed	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: EPA
Author name: Stephanie Linebaugh
Author affiliation: EPA
Review period: 11/1/2012 - 5/30/2013
Date of site inspection: 6/13/2013
Type of review: Statutory
Review number: 2
Triggering action date: 6/26/2008
Due date *(five years after triggering action date)*: 6/26/2013

Five-Year Review Summary Form (continued)

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
2

Protectiveness Statement(s)	
Operable Unit: 2	*Protectiveness Determination:* Will be Protective
Protectiveness Statement: The selected interim remedy for OU2 is expected to be protective of human health and the environment upon completion of the final OU2 groundwater remedy. Data collected during the past five year period demonstrates the OU2 interim remedy is operating as intended and making progress towards achieving the RAOs identified in the interim ROD. The GMCS is significantly reducing the discharge of contaminated groundwater into the Mississippi River as measured by the attainment of a zero or inward hydraulic gradient across the barrier wall and a 98 percent reduction in the mass flux of contaminants to the River.	

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). CERCLA Section 121 states:

> *"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."*

EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which states:

> *"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action."*

EPA conducted a FYR on the remedy implemented at the Sauget Area 2 Superfund Site in Sauget and Cahokia, St. Clair County, Illinois. EPA is the lead agency for developing and implementing the remedy for the Site. The Illinois Environmental Protection Agency (Illinois EPA), as the support agency representing the State of Illinois, has reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the second FYR for the Sauget Area 2 Superfund Site. The triggering action for this statutory review is the completion date of the previous FYR. The FYR is required because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure. The Site consists of two Operable Units (OUs), but only OU2 is addressed in this FYR.

II. PROGRESS SINCE THE LAST REVIEW

Table 1: Protectiveness Determinations/Statements from the 2008 FYR

OU #	Protectiveness Determination	Protectiveness Statement
2	Protectiveness Deferred	A protectiveness determination for the OU2 interim remedy cannot be made until performance measures for the GMCS are developed and implemented. Although the protectiveness determination cannot be made at this time, the OU2 interim remedy is serving to reduce the mass loading of contaminants to the Mississippi River by removing and treating groundwater from the contaminated aquifers. In addition, access and informational controls limit the occurrence of recreational fishing in the vicinity of the Site, and ordinances prohibiting groundwater use are in place for the majority of the Site.

Table 2: Status of Recommendations from the 2008 FYR

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Party	Original Milestone Date	Current Status	Completion Date (if applicable)
2	Although the GMCS is removing contaminant mass from the aquifer, performance measures for the OU2 interim remedy have not been finalized. Performance measures include the procedures for calculating mass loading to the Mississippi River, controlling the pumping rates across the barrier wall to achieve a zero or inward gradient, and evaluating groundwater, surface water, and sediment data.	Evaluate the performance measures as part of the ongoing supplemental RI/FS	PRP	EPA	9/30/2009	Completed; Performance measures were finalized in the O & M Plan (May 2013), and have been implemented since March 2010.	5/13/2013

Remedy Implementation Activities

The interim remedy consists of a 3,500 foot U-shaped barrier wall that is 140 feet deep and terminates in bedrock, a groundwater extraction system, and treatment of contaminated groundwater through the American Bottoms Regional Wastewater Treatment Facility (ABRTF) prior to being discharged to the Mississippi River.

Table 3: Summary of Planned and/or Implemented Institutional Controls (ICs)

Media, engineered controls, and areas that do not support UU/UE based on current conditions	**ICs Needed**	**ICs Called for in the Decision Documents**	**IC Objective**	**Title of IC Instrument Implemented and Date (or planned)**
Groundwater discharge to surface water (see Attachment 1, Figure 5)	Yes	Yes	Restrict fishing near contaminated areas	Fish advisories and warning signs
Groundwater (review of existing groundwater contamination will be done as part of the regional groundwater (Sauget Area 1 and Sauget Area 2 Sites) ROD)		No, but will be reviewed under final regional groundwater remedy	Prohibit groundwater use	Ordinance #99-5- Village of Sauget Ordinance #97-10066 - City of East St. Louis

One objective of the access controls listed in the OU2 interim ROD was to limit fishing in the plume release area. Access to the Mississippi River in the plume release area is limited by existing fencing at Site R, locked entrance gates, a very steep riverbank and the absence of public roads leading to the area. Institutional controls used at the Site include warning signs posted near the northern and southern portions of Site along the riverbank. Routine maintenance in the Operation and Maintenance (O&M) Plan includes quarterly inspections of warning signs, perimeter fencing and locks to ensure they are in place and effective.

Although not required by the OU2 interim ROD, two ICs that are in place in the vicinity of Sauget Area 2 are ordinances passed by the Village of Sauget in 1999 and by the City of East St. Louis in 1997. Both ordinances prohibit use of groundwater for drinking within the corporate limits of the municipality. The evaluation of ICs prohibiting groundwater use in the area of the Sauget Area 2 Sites will be part of the final regional (Sauget Area 1 and Sauget Area 2 Sites) groundwater ROD.

Another institutional control in place for the Site is excavation restrictions to protect construction workers at Site R. The restrictions are in place to prevent trenching without appropriate protection of construction workers and to define requirements for training, protection and monitoring of construction and outdoor industrial workers.

Current Compliance
Routine maintenance in the O&M Plan includes quarterly inspections of warning signs, perimeter fencing and locks to ensure they are still in place and effective. During interviews with local officials and the implementing potentially responsible parties (PRPs), no problems were noted.

Long-Term Stewardship
As stated above, the O&M Plan includes quarterly inspections of warning signs, perimeter fencing and locks. The regional groundwater ROD will evaluate the adequacy of the ICs currently in place and determine if other measures are necessary. If it is determined in the regional groundwater ROD that additional institutional controls are necessary, a long-term plan for evaluating, monitoring, and maintaining the additional controls will be developed.

System Operation/Operation and Maintenance Activities

The selected interim remedy was chosen because it would greatly reduce the environmental impacts associated with the release of contaminated groundwater to the Mississippi River from the Sauget Area Sites and in the vicinity of Site R. This was to be accomplished through the containment and extraction of contaminated groundwater downgradient of Site R, thereby reducing mass loading to the Mississippi River. Reduction of mass loading would abate aquatic organism exposure to impacted groundwater, contamination of ecosystems, and sediment toxicity.

In order to determine if the GMCS was operating as specified in the interim ROD and meeting the remedial action objective (RAO) of pumping out the amount of groundwater that naturally flows into the barrier wall (e.g., obtaining a "zero" or "inward" gradient across the barrier wall), the operational parameters were optimized and verified through a series of four 90-day Interim Operational Periods (IOPs) overseen by EPA.

IOP I began December 1, 2004 and ended February 28, 2005. IOP II was conducted using groundwater flow into the barrier wall, computed using Darcy's Law, as a performance measure from August 1, 2005 through October 31, 2005. IOP II concluded that additional operational data were needed to optimize and simplify operation of the system. IOP III was conducted February 1, 2006 through May 31, 2006, in which results concluded the flow data obtained during IOP I, II and III demonstrate that using Darcy's Law provides flow estimates that are very close to actual inflow. IOP IV was conducted from October 1, 2009 through February 15, 2010, to confirm the results for IOP III. Completion of IOP IV demonstrated that the GMCS meets System Convergence (achieves a zero/inward gradient) over 95 percent of the time over a wide range of river elevations and pumping rates. Since October 2009, the GMCS has operated as described in the IOP IV Work Plan (November 2009) which has been incorporated into the approved O&M Plan (May 2013).

To help characterize the impact that the GMCS is having on the surrounding environment, the Operation and Maintenance Plan (O&M Plan) requires the semi-annual collection and testing of surface water samples from the Mississippi River to determine the effect of any contaminants

migrating through, past, or beneath the barrier wall and being released to the Mississippi River.

Surface water samples have been collected since 2005 and will continue to be collected from Sampling Stations 2, 3, 4, 5 and 9, which are located in the former plume release area. Samples are analyzed for volatile organic compounds (VOCs), semi-organic compounds (SVOCs), herbicides, pesticides and metals. These surface water samples will continue to be collected once during a typical low-flow period in the spring or early summer, and once during a typical low flow period in the fall or early winter.

The site specific, surface water benchmarks developed for this Site are as follows:

2, 4-dichlorophenoxyacetic acid (or 2, 4 –D)	8 micrograms per liter (ug/L)
Chlorobenzene	50 ug/L
P-Chloroaniline	50 micrograms per liter

EPA approved the O&M Plan in May 2013, thus, surface water sample results will now be compared to the surface water benchmarks listed above to see if levels over time are above benchmarks and/or increasing. Exceedances of benchmark compounds during a sampling event will be evaluated further using co-located surface water samples and additional toxicity testing. Sediment toxicity sampling will be required if long term monitoring of surface water shows concentrations of 2, 4-D, chlorobenzene or P-chloroanline above surface water benchmarks.

A comprehensive list of routine maintenance activities for both the barrier wall and the extraction system is included in the O&M Plan. Some of the routine O&M activities include making backups of data, measurement of back pressure in discharge lines at each well, inspection of motors, periodic downhole video inspection of well screens, checking for bio-fouling in wells, verification of valve settings in actuators, and checking A/C and heater filters. In addition, on a quarterly basis, the stockpile containment cell cover is inspected for erosion and ponding caused by settlement; warning signs, fencing and locks are checked; and erosion controls and drainage structures are inspected. The alignment of the slurry wall is checked annually for signs of settlement or subsidence. Based on information provided by the PRPs, annual O&M costs for the GMCS are estimated at $2,000,000/year.

III. FIVE-YEAR REVIEW PROCESS

Administrative Components

EPA notified the potentially responsible parties (PRPs) for the Site of the initiation of the five-year review on November 1, 2012. The Sauget Area 2 Superfund Site Five-Year Review was led by Stephanie Linebaugh, EPA Remedial Project Manager for the Site, and Patricia Krause, the Community Involvement Coordinator (CIC). Paul Lake, of the Illinois EPA, assisted in the review as the representative for the support agency (Illinois EPA).

The review, which began on November 1, 2012, consisted of the following components:

- Community Involvement;
- Document Review;
- Data Review;
- Site Inspection; and
- Five-Year Review Report Development and Review.

Community Notification and Involvement

EPA initiated activities to involve the community in the five-year review process after a meeting in November 2012 between the RPM and CIC for the Site. A notice was published in the local newspaper, the *Belleville News-Democrat* on March 24, 2013, stating that EPA was beginning a five-year review and inviting the public to submit any comments to EPA. The results of the review and the report will be made available at the Site information repository located at Cahokia Public Library, 140 Cahokia Park Drive, Cahokia, Illinois.

Document Review

This FYR consisted of a review of relevant documents, including O&M records and monitoring data. As part of this effort, EPA also reviewed performance standards for calculating mass flux, controlling pumping rates for achieving zero or inward hydraulic gradient across the barrier wall and site-specific, protective surface water concentration benchmarks, as required in the September 30, 2002 interim ROD and in the approved O&M Plan.

Data Review

The RAO performance measures for the barrier wall and extraction system specified in the OU2 interim ROD were: (1) calculation of mass loading to the Mississippi River, (2) control of the gradient across the barrier wall, and (3) groundwater, surface water, and sediment sampling. The required sampling and data collection has occurred as stated in the O&M Plan since the 2008 FYR. The procedures for each of the performance measures for calculating mass flux, pumping rates and site-specific contaminant benchmarks were finalized and approved in the final O&M Plan (May 2013).

No compliance violations related to the Sauget Area 2 Site have occurred at the ABRTF between 2008 and 2013. On two separate occasions during this time period, ABRTF requested that the implementing PRPs shut down the GMCS. These requests were mostly due to heavy storm events.

Summary of Field Activities

The following discussion provides a summary of field activities and results of the groundwater and surface water monitoring at Site R during the Quarterly Groundwater Monitoring Sampling Events from March 2008 through September 2012.

Performance verification sampling for the Site R GMCS has included quarterly groundwater sampling and semi-annual surface water and sediment sampling since 2005. Sampling efforts and results are discussed in the following sections for the period 2008 to 2012. Sampling has

taken place in 2013; however, EPA has not yet received reports for 2013 results.

Quarterly Groundwater Sampling

Quarterly Groundwater Monitoring Sampling Events have been performed by the PRPs' consultant, Golder Associates Inc., on twelve barrier wall monitoring wells from June 2005 to the present (Appendix B, Attachment 1). Sampling events from March 2008 through September 2012 are included in this evaluation based on the twenty Quarterly Groundwater Monitoring reports submitted by the PRP for this period.

The monitoring wells were purged using low-flow techniques with an adjustable flow-rate down-hole pump and dedicated polyethylene tubing. Water quality parameters were evaluated in the field, including pH, temperature, specific conductivity and turbidity. Each well was sampled following purging until the turbidity value decreased to less than 5 nephelometric turbidity units (NTU), or stabilization of field parameters was achieved for one hour, whichever occurred first. The samples were analyzed for VOCs, SVOCs, herbicides, pesticides, metals, Total Organic Carbon (TOC) and Total Dissolved Solids (TDS).

The monitoring wells have been sampled by the PRPs with EPA oversight on a quarterly basis over the period March 2008 through September 2012. Analytes detected in the groundwater samples have varied over time, but have consistently included detections of VOCs, SVOCs, pesticides, herbicides and metals.

Groundwater Data Review

Quarterly groundwater sampling data have been collected since June 2005 for four sets of nested monitoring wells located between the barrier wall and the River. The compliance wells are labeled BWMW-1 through 4, with three vertical completions per well nest labeled shallow (S), middle (M) and deep (D). The groundwater samples are analyzed for:

- Volatile Organic Compounds (EPA Method 8260B)
- Semi-Volatile Organic Compounds (EPA Method 8270C)
- Organochlorine Pesticides (EPA Method 8081A)
- Chlorinated Herbicides (EPA Method 8151A)
- Total Organic Carbon (EPA Method 9060)
- Mercury (EPA Method 7470A)
- Metals (EPA Method 6010B)
- Total Dissolved Solids (EPA Method 160.1)

A regression analysis was conducted on the twelve wells (4 locations and 3 depths per location) and the four indicator chemicals. The regression analysis looked at the following (See Appendix B, Attachment 1):

- **Comparison to the compliance criteria:** The geometric mean of the last four measurements was used to reduce the effects of seasonal variation, for comparison to the compliance criteria.
- **Data set:** Entire record (June 2005 through December 2012).
- **Statistical significance:** The significance of the goodness-of-fit of the regression was evaluated using a confidence level (α) of 95 percent.

- **Attenuation (decay) rate:** The attenuation rate was estimated using a first-order decay model.
- **Time to achieve compliance:** The attenuation rates were used to forward estimate the time to achieve the compliance criterion.

In general, water quality changes over the period of record have been improving more quickly in the northern well group (BWMW-1) and the rates of decay lessen to the south.

Most compounds exhibit stable or decreasing concentration trends. Increasing concentrations were observed at BWMW-3D for benzene and at BWMW-4D for 1-4 dichlorobenzene and chlorobenzene.

Semi-annual Sediment and Surface Water Sampling

Semi-annual sediment and surface water sampling events have been performed by the PRPs' consultant, URS, at five stations in the Mississippi River from September 2005 to March 2013.

Sediment and surface water samples have been collected in sample locations adjacent to Site R to determine the concentrations over time of any contaminants migrating through, around or potentially beneath the barrier wall and discharging into the Mississippi River. Under the Performance Standard Verification Plan (Volume 3 of the July 2003 GMCS Final Design Submittal), surface water and sediment samples were identified for collection at five locations designated as plume discharge area (PDA) -2, 3, 4, 5, and 9 (See Appendix B, Attachment 1). These five locations were chosen because toxicity was observed during the October/November 2000 sampling event by Menzie-Cura & Associates, Inc., which were summarized in an Ecological Risk Assessment (ERA) performed for the W.G. Krummrich Facility under EPA RCRA jurisdiction. The ERA became a basis for the installation of the Site R GMCS and barrier wall.

Surface Water and Sediment Data Review

Sediment and surface water have been sampled on a semi-annual basis, since September 2005. Analytes detected in the sediment and surface water samples have varied over time, but have consistently included detections of VOCs, SVOCs, pesticides, herbicides and metals. In order to show the trend over time for select constituents, logarithmic plots of concentration over time were prepared (See Appendix A, Attachment 1).

In comparing surface water data during this five year review period (2008-2013) to the site benchmarks, the only time that the surface water exceeded the benchmark was in September 2009 with sample results for chlorobenzene = 4,400 ug/L (benchmark = 50 ug/L) and p-chloroanaline = 6,200 ug/L (benchmark = 50 ug/L) at PDA Station 2. Results from sampling in September 2010 indicated high concentrations of chlorobenzene and p-chloroaniline in sediment samples collected from station PDA-2. EPA instructed the PRPs to collect additional samples within the area of the higher concentrations and six additional sample locations were identified for the November 2010 sampling event. Of the six locations, two could not be sampled due to obstructions at the locations. A total of four additional surface water and sediment samples were collected. Results from the additional sample locations indicated non-detects for chlorobenzene and p-chloroaniline in the additional samples; therefore it was concluded that these exceedences were an anomaly.

Site Inspection

EPA conducted the FYR Site inspection on June 13, 2013. In attendance were Stephanie Linebaugh (EPA); Paul Lake (Illinois EPA), EPA Oversight Contractors, Lisa Cundiff and Bob Goodson (CH2M Hill), PRP Group representatives, Steve Smith and Bill Johnson (Solutia) and PRP Group consultant, Melissa Felton (URS). The purpose of the inspection was to assess the protectiveness of the remedy.

No significant issues were noted during the Site inspection. A minor issue noted during the Site inspection is the need for better monitoring well maintenance. Specifically, weeds need to be trimmed around the monitoring wells and monitoring well locks need to be checked. This minor issue was discussed with the PRPs during the Site inspection and PRPs will address this issue promptly.

IV. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Since the last FYR, the Remedial Action Completion Report (October 2009) and the O&M Plan (May 2013) have been finalized. Data collected during the past five year period demonstrate that the OU2 interim remedy is operating as intended and making progress towards meeting the RAOs identified in the interim ROD. The GMCS is significantly reducing the discharge of contaminated groundwater into the Mississippi River as measured by the attainment of a zero or inward hydraulic gradient across the barrier wall and a 98 percent reduction in the mass flux of contaminants to the River.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy section still valid?

Yes. The assumptions and information on which the OU2 interim ROD was based are still valid. There have been no changes in the physical conditions at the Site or in land use that would affect the protectiveness of the remedy. The GMCS is significantly reducing releases into the Mississippi River and is making progress towards achieving the RAOs.

Changes in Standards and To-Be-Considered Requirements
Due to the limited scope of the interim remedy for OU2, EPA invoked an interim action waiver of chemical-specific ARARs during finalization of the OU2 interim ROD. No changes in the location-specific or action-specific ARARs have been made and no new standards or to be considered (TBC) requirements affecting the protectiveness of the remedy have been identified.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics
There have been no changes in exposure pathways, toxicity, and/or other contaminant characteristics since the last five year review.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. There has been no information, such as changes in land use or changes in Site conditions, which would call into question the protectiveness of the remedy.

Technical Assessment Summary

Data collected during the past five year period demonstrate that the OU2 interim remedy is operating as intended and making progress towards meeting the RAOs identified in the interim ROD. The GMCS is significantly reducing the discharge of contaminated groundwater into the Mississippi River as measured by the attainment of a zero or inward hydraulic gradient across the barrier wall and a 98 percent reduction in the mass flux of contaminants to the River.

V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No issues or recommendations were identified for the OU2 interim remedy during this five year review period.

VI. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Operable Unit: 2	*Protectiveness Determination:* Will be Protective
Protectiveness Statement: The selected interim remedy for OU2 is expected to be protective of human health and the environment upon completion of the final OU2 groundwater remedy. Data collected during the past five year period demonstrates the OU2 interim remedy is operating as intended and making progress towards achieving the RAOs identified in the interim ROD. The GMCS is significantly reducing the discharge of contaminated groundwater into the Mississippi River as measured by the attainment of a zero or inward hydraulic gradient across the barrier wall and a 98 percent reduction in the mass flux of contaminants to the River.	

VII. NEXT REVIEW

The next five-year review report for the Sauget Area 2 Superfund Site is required five years from the completion date of this review.

APPENDIX A – EXISTING SITE INFORMATION

A. SITE CHRONOLOGY

Table 1: Site Chronology

Event	Date
Industrial Salvage and Disposal, Inc. operated the industrial waste landfill now called Site R	1957 to 1977
Monsanto completed clay cover over Site R	1979
Monsanto completed stabilization project along Mississippi River adjacent to Site R	1985
State of Illinois and Monsanto signed a Consent Decree for a Remedial Investigation/ Feasibility Study (RI/FS)	February 13, 1992
First Removal Action Conducted for OU1	February 1995
Second Removal Action Conducted for OU1	October 1999
Monsanto signs a RCRA Administrative Order on Consent (AOC) with EPA	May 3, 2000
AOC for RI/FS Signed	November 24, 2000
Ecological Risk Assessment for Mississippi River	June 2001
Proposed to NPL	September 13, 2001
EPA sent request to implementing PRPs to conduct a focused feasibility study (FFS) of Site R	November 14, 2001
FFS submitted to EPA	April 1, 2002
Public Comment Period on Proposed Plan for Site R	June 17, 2002 to August 16, 2002
Interim ROD for Site R Groundwater OU2 signed	September 30, 2002
UAO for RD/RA for OU2 issued	September 30, 2002
Start of Remedial Design for OU2	February 15, 2003
Explanation of Significant Differences signed	July 30, 2003
RA Construction Start OU2	August 18, 2003
Performance Verification Sampling begins	June 2005
RA Construction Completed OU2	November 2005
First Five Year Review Completed	June 26, 2008

B. BACKGROUND

Physical Characteristics

Sauget Area 2 is located on the eastern side of the Mississippi River directly opposite St. Louis, Missouri (See Appendix B, Attachment 2, Figure 1). More specifically, the Sauget Area 2 site is situated south of East St. Louis, Illinois, within the boundaries of the City of East St. Louis and the Villages of Cahokia and Sauget, Illinois. The site extends approximately three-quarters to one mile east of the eastern bank of the Mississippi River.

The Sauget Area 2 site as a whole consists of five inactive disposal areas (Sites O, P, Q, R and S) described in Table 2 below. Of these disposal sites, three are closed landfills (Sites P, Q and R), one consists of four closed sludge lagoons (Site O), and one is a waste disposal site (Site S)

associated with an abandoned solvent reclamation facility (See Appendix B, Attachment 2, Figure 1). The locations and acreage of each site are shown in the table below.

Table 2. Descriptions of Sauget Area 2 Disposal Areas

Site Name	Size (acres)	Location	Description
Site O	20	Sauget, Illinois	Located on Mobile Avenue, northeast of the American Bottoms Regional Wastewater Treatment Facility (ABRTF) and east of the flood control levee.
Site P	20	East St. Louis and Sauget, Illinois	Bounded by Illinois Central Gulf Railroad tracks, the Terminal Railroad Association tracks and Monsanto Avenue.
Site Q – northern portion	65	Sauget and Cahokia, Illinois	The northern portion of Site Q is bordered on the north by Site R and Monsanto Avenue; on the south by the main track of the Alton and Southern Railroad; on the east by the flood control levee; and on the west by the Mississippi River. The northern portion of Site Q that wraps around the eastern boundary of Site R is known as the "dogleg" portion of Site Q.
Site Q – southern portion	25	Sauget and Cahokia, Illinois	The southern portion of Site Q is bordered on the north by the Alton and Southern Railroad; on the south by Cargill Road; on the east by the flood control levee and the Illinois Central Gulf Railroad; and on the west by a 10-foot wide easement owned by Union Electric for transmission lines and a spur track of the Alton and Southern Railroad.
Site R	36	Sauget, Illinois	Site R is bounded on the north by Monsanto Avenue; on the east by the dogleg portion of Site Q; on the south by the main portion of Site Q; and on the west by the Mississippi River. The address for the site is 5 Riverview Avenue.
Site S	<1	Sauget, Illinois	Site S is less than one acre in size and is located southwest of Site O.

Sauget Area 2 is situated in a floodplain of the Mississippi River called the American Bottoms (See Appendix B, Attachment 2, Figure 2). In total, the American Bottoms floodplain encompasses 175 square miles, is 30 miles long, and has a maximum width of 11 miles. It is bordered on the west by the Mississippi River and on the east by bluffs that rise 150 to 200 feet above the valley bottom. The floodplain is relatively flat and generally slopes from north to south and from east to west. Land surface lies between 400 and 445 feet above mean sea level

(msl).

Two types of water-bearing formations exist in the American Bottoms floodplain area: unconsolidated and consolidated. The unconsolidated formations (predominantly silt, sand, and gravel) are those that lie between the ground surface and the bedrock/gravel interface. The thickness of the unconsolidated formation varies throughout the area but is typically estimated to be approximately 100 feet. Finer-grained sediments generally dominate at the ground surface and become coarser and more permeable with depth, creating semi-confined conditions within the aquifer. The consolidated formations are deep bedrock units of limestone and dolomite that exhibit low permeability and are not considered to be a significant source for groundwater in the area. The groundwater level in the vicinity of Site R is generally between 10 to 20 feet below ground surface, but fluctuates during times of precipitation. Recharge to the aquifer occurs through four sources: precipitation, infiltration from the Mississippi River, inflow from the buried valley channel of the Mississippi River, and subsurface flow from the bluffs that border the floodplain on the east.

Three distinct hydrogeologic units can be identified in the vicinity of Site R: (1) a shallow hydrogeologic unit (SHU); (2) a middle hydrogeologic unit (MHU); and (3) a deep hydrogeologic unit (DHU). The 20 feet thick SHU includes the Cahokia Alluvium (recent deposits) and the uppermost portion of the Henry Formation. The 30 feet thick MHU is formed by the upper to middle, medium to coarse sand portions of the Henry Formation. At the bottom of the aquifer is the DHU, which includes the high permeability, coarse-grained deposits of the lower Henry Formation. This zone is 40 feet thick. Groundwater flow velocity is on the order of 0.02 feet per day (7 feet per year) in the SHU, 4 feet per day (1,500 feet per year) in the MHU, and 6 feet per day (2,200 feet per year) in the DHU.

During low river stage conditions, groundwater at Sauget Area 2 flows from east to west and releases to the Mississippi River, the natural point of release for groundwater in the American Bottoms aquifer. When flood stage occurs in the Mississippi River, flow reverses. Under these conditions, groundwater flows from west to east.

Land and Resource Use

Heavy industry has been present on the east bank of the Mississippi River between Cahokia and Alton, Illinois, for nearly a century. Industrial activity in the area peaked in the 1960s. Although many industrial facilities have closed down throughout the American Bottoms floodplain, Sauget Area 2 and the surrounding area is still highly industrialized (See Appendix B, Attachment 2, Figure 3). Currently, the area is used for industry, warehousing, bulk storage (coal, refined petroleum, lawn and garden products and grain), wastewater treatment, hazardous waste treatment, waste recycling and truck terminals. In addition to heavy industry, the area also has commercial facilities, bars, nightclubs, convenience stores and restaurants. A number of petroleum, petroleum product, and natural gas pipelines are located in the area.

No residential land use is located immediately adjacent to or downgradient of Sites O, P, Q, R and S and other industrial facilities in the Sauget area. Residential areas of Sauget and East St. Louis are separated from the Sauget Area 2 area by other industries or by undeveloped tracts of land. Limited residential areas exist approximately 3,000 feet to the northeast and southeast of

the site. According to the 2010 census, the population of the Village of Sauget, which is where the majority of the Sauget Area 2 site is located, is 159.

In addition to manufacturing, Sauget and the surrounding areas have historically been used for waste disposal. Six closed landfills (Sauget Area 2 Sites P, Q and R and Sauget Area 1 Sites G, H and I), four closed sludge lagoons (Sauget Area 2 Site O), a closed tank-truck wash water lagoon (Sauget Area 1 Site L) and a waste disposal site (Sauget Area 2 Site S) associated with an abandoned solvent reclamation facility (Resource Recovery Group) are located in the Sauget area. The Sauget Area 1 site is proposed for the National Priorities List (NPL) and is currently being investigated. The W.G. Krummrich manufacturing plant is a Resource Conservation and Recovery Act (RCRA) facility located approximately 3,000 feet to the east of Site R. The W.G. Krummrich facility is conducting a remedial action under a RCRA Administrative Order on Consent.

In the past, groundwater from the American Bottoms aquifer was a major source of water for the area and was used for industrial, public, and irrigation purposes. Groundwater levels prior to industrial and urban development were near land surface. Intensive industrial withdrawal, along with the use and construction of a system of drainage ditches, levees, and canals to protect developed areas, lowered the groundwater elevation for many years. By the mid-1980s, however, the groundwater levels had increased due to reduced pumping, high river stages, and high precipitation. Currently, no groundwater is being pumped from the American Bottoms aquifer in the vicinity of Sauget Area 2 for public, private or industrial supply purposes.

Groundwater is not a source of drinking water in the area. The Village of Sauget and the City of East St. Louis have issued ordinances prohibiting the use of groundwater as a potable water source (See Appendix B, Attachment 3). These ordinances were issued in response to historic industrial land use in the region and resulting groundwater quality impairments. The Village of Cahokia has an ordinance that restricts groundwater use in part of the municipality, but it does not cover the portion of the Sauget Area 2 site that is located in Cahokia. Groundwater use restrictions will likely remain in place for the foreseeable future due to the extent of the groundwater quality impairments.

The source of drinking water for area residents is an intake in the Mississippi River. This intake is located at River Mile 181, approximately three miles north and upgradient of Sauget Area 2. The drinking water intake is owned and operated by the Illinois American Water Company (IAWC) of East St. Louis, and it serves the majority of residences in the area. IAWC supplies water to Sauget and also to portions of Cahokia and Centerville Township. Public water supply is the exclusive potable water source in the vicinity of the Sauget Area 2 site.

The nearest downstream surface-water intake on the Illinois side of the Mississippi River is located at River Mile 110, approximately 68 miles south of Sauget Area 2. This intake supplies drinking water to residents in the Town of Chester and surrounding areas in Randolf County, Illinois. The nearest downstream public water supply on the Missouri side of the river is located at River Mile 149, approximately 29 miles south of Sauget Area 2. At this location, the Village of Crystal City, Missouri, utilizes a Ranney well adjacent to the Mississippi River as a source for drinking water.

The Mississippi River is the major surface water body draining the area. The stretch of the river adjacent to Site R is bounded by steep embankments lined with rip-rap. A few scattered structures in the river, such as a wing dam and a sunken barge, offer some access points for aquatic birds and mammals and potential protection for fish. In the vicinity of Site R, no bordering wetlands, appreciable bordering vegetation, or submerged or emergent vegetation are present. Recreational and commercial fishing does occur in the Mississippi River; however, no fishing access is available along the Site R border. The Sauget Area 2 property is used as habitat by at least six threatened and endangered species, including the federally threatened bald eagle and state endangered snowy egret and little blue heron.

Future land use for the Sauget Area 2 site and surrounding areas are anticipated to be similar to current land use.

History of Contamination

As stated above, the Sauget Area 2 site as a whole consists of five inactive disposal areas -- Sites O, P, Q, R and S. A brief description of the disposal and contaminant history for each of the disposal sites is below.

Site O - In 1952, the Village of Sauget began operating a wastewater treatment plant in the area now referred to as Site O. In addition to providing treatment for the Village of Sauget, the plant treated effluent from a number of Sauget industries. In 1965, the four lagoons which comprise Site O were constructed at the site. Between approximately 1966 and 1978, the lagoons were used to dispose of clarifier sludge from the Village of Sauget wastewater plant. Compounds detected in subsurface soil and/or groundwater in the area of Site O include toluene, xylenes, trichloroethene, tetrachloroethene, polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxin, chlorobenzenes, chlorophenols, and chloroanilines.

Site P - Disposal Site P was operated by Sauget and Company from 1973 to approximately 1984. It was an IEPA-permitted landfill and was used for municipal and industrial waste disposal. Some of the general industrial wastes accepted at Site P included diatomaceous-earth filter cake from the Edwin Cooper Company and non-chemical waste from Monsanto.

Site Q - Between the 1950s and the 1970s, Site Q operated as a landfill that accepted municipal waste, septic tank pumpings, drums, organic and inorganics wastes, solvents, pesticides, paint sludges, plant trash, waste from industrial facilities, and demolition debris. Disposal at Site Q occurred both on the surface and subsurface. Compounds detected in soil and/or groundwater in the area of Site Q include toluene, xylenes, PAHs, phthalates, chlorobenzenes, chlorophenols, including pentachlorophenol (PCP), and chloroanilines.

Site R - Industrial Salvage and Disposal Inc. operated the River's Edge Landfill, now called Site R, for Monsanto from 1957 to 1977. Hazardous and non-hazardous bulk liquid and solid chemical wastes and drummed chemical wastes from Monsanto's W.G. Krummrich plant and, to a lesser degree its Queeny plant in St. Louis, were disposed of at the site. Disposal began in the northern portion of the site and expanded southward. Wastes contained toluene, xylenes, PAHs, chlorobenzenes, chlorophenols, PCP, chloroanilines, phenols, aromatic nitro compounds,

aromatic amines, aromatic nitro amines, chlorinated aromatic hydrocarbons, aromatic and aliphatic carboxylic acids and condensation products of these compounds.

Site S - In the mid-1960s, wastes from the former Clayton Chemical property were disposed of in a shallow, on-site excavation which is now designated as disposal Site S. The wastes were from the solvent recovery process at Clayton which involved steam-stripping. Still bottoms from the stripping process were disposed of at the site.

Three known groundwater concentration highs are present in groundwater beneath and upgradient of Sauget Area 2 Site R: one at Sauget Area 2 Sites R and Q immediately adjacent to the Mississippi River, another at the location of Sauget Area 2 Sites O and S, and a third at the W.G. Krummrich plant. Groundwater data indicate there is a distinct vertical stratification of total volatile organic compound (VOC) and total semi-volatile organic compound (SVOC) concentrations at Site R with concentrations decreasing with depth. The results below are from samples collected in January and May 2000.

	Total VOC Concentration (ppb)	**Total SVOC Concentration (ppb)**
Shallow Hydrogeologic Unit	74,600	6,760,000
Middle Hydrogeologic Unit	47,210	1,529,000
Deep Hydrogeologic Unit	1,950	34,800

This distinct vertical concentration gradient, with the highest detected concentrations in the upper portions of the saturated zone, indicates that the waste material and/or dense non-aqueous phase liquid (DNAPL) in the SHU are acting as a source that impacts groundwater quality. Total SVOC concentrations of 6,760,000 in the SHU and 1,529,000 in the MHU indicate that DNAPL is probably present in the aquifer. Dissolution of DNAPL coating the aquifer matrix or trapped in aquifer pore spaces will act as a long-term, continuous source for impacting groundwater.

Initial Response

A number of initial response actions have been taken at three of the five sites that comprise the Sauget Area 2 site. No action has been taken at Site P or Site S. Initial response actions taken at Sites O, Q, and R are summarized below.

Site O

In 1980, the Village of Sauget closed the four lagoons that comprise Site O by stabilizing the sludge with lime and covering it with approximately two feet of soil. The construction of the cover was not overseen or approved by either USEPA or IEPA. Currently, the former lagoons are vegetated.

Site Q

In 1993, Site Q was flooded and river currents unearthed a number of barrels containing hazardous waste. USEPA conducted a removal action in the northern portion of Site Q in 1995 to stabilize the area scoured by the flood waters. On October 18, 1999, USEPA initiated a second removal action at Site Q. USEPA excavated site waste from eight different areas on the 25-acre southern portion of Site Q. The excavations were primarily focused on two former

ponds in the southeast corner of Site Q. Two waste streams were developed based on analytical results of the waste piles: a low-level waste stream with soil concentrations less than 50 part per million (ppm) of PCBs and a high-level waste stream with soil concentrations greater than 50 ppm of PCBs. Approximately 17,032 tons of waste, comprised of about 20 percent low-level waste and 80 percent high-level waste were shipped off-site for disposal. In addition, 3,271 drums were removed and disposed of. The second removal action was completed on April 5, 2000.

Site R

Pursuant to a negotiated agreement with the State of Illinois, Monsanto installed a clay cover on Site R in 1979 to cover the waste, limit surface water infiltration through the landfill, and prevent direct contact with the landfill material. The cover thickness ranges from 2 feet to approximately 8 feet. In 1985, Monsanto installed a 2,250 foot long rock revetment along the east bank of the Mississippi River downgradient of Site R. The purpose of the stabilization project was to prevent further erosion of the riverbank and thereby minimize potential for the release of waste material from the landfill. During a flood in 1993, Site R was flooded but the clay cap was not overtopped. No erosion of the riverbank or cap resulted from this flood.

Basis for Taking Action

Several ecological risk and exposure assessments related to the Sauget Area 2 site have been completed. The results from the two ecological risk assessments completed in the 1990s are summarized in the OU2 interim ROD. The results from the most recent ecological risk assessments, the first completed in June 2001 and the second completed in draft form in August 2003, are summarized below. A comprehensive ecological risk assessment is being completed as part of the on-going remedial investigation for the Sauget Area 2 site.

During past ecological risk evaluations of the Sauget Area 2 site, the main area that has been studied extends approximately 2,000 feet along the riverbank next to Site R and 300 feet into the river channel. The study area is referred to as the plume discharge area (PDA) (See Appendix B, Attachment 2, Figure 4). Contaminated groundwater in the PDA originates for the most part from Sauget Area 2 Site R; however, some contaminated groundwater from two other Sauget Area 2 sites (Sites O and Q), Sauget Area 1 Site I, the W.G. Krummrich facility, and the Clayton Chemical facility may also be discharging to the river in this area. Other groundwater plumes related to the Sauget Area 2 site which are not being captured by the barrier wall are being assessed as part of the on-going remedial investigation.

In the 2001 assessment of ecological risk, surface water, sediment and fish tissue samples were collected from the Mississippi River. For the assessment, 29 chemicals of potential concern (COPCs) in soil and groundwater at Sauget Area 2 Site R were identified to be:

VOCs	SVOCs	Pesticides/PCBs	Metals
benzene	aniline	alpha-BHC[1]	antimony
chlorobenzene	4-chloroaniline	PCBs	arsenic
1,2-dichloroethane	naphthalene		beryllium
dichloroethylene	1,2-dichlorobenzene		boron

[1] Alpha-benzene hexachloride

methyl chloride	nitrobenzene	nickel
methylene chloride	2-nitrochlorobenzene	thallium
tetrachloroethylene	phenol	cyanide
vinyl chloride	2,4-dimethylphenol	
	2-chlorophenol	
	2,4-dichlorophenol	
	2,4,6-trichlorophenol	
	pentachlorophenol	

The 2001 ecological risk assessment revealed that fish species are at risk from exposure to sediment; fish prey are at risk from exposure to surface water; and a number of compounds found in sediment, surface water and fish tissue were not found in areas upstream of the study area. Potential complete exposure pathways in the study area include: (1) sediment to benthic invertebrates via direct contact and ingestion; (2) surface water to invertebrates and fish through direct contact and ingestion; (3) benthic biota to higher order predators through the food chain; and (4) fish to piscivorous fish, mammals and birds via ingestion. The conclusions in the 2001 ecological risk assessment were:

- Fish species are at risk from exposure to sediment based on the results of toxicity testing.

- Fish prey, such as planktonic invertebrates, are at risk from exposure to surface water based on toxicity tests. Benthic organisms are also at risk from exposure to sediment based on laboratory toxicity tests. However, the inherent high-energy physical environment in the study area in the Mississippi River limits the number of benthic invertebrates. Therefore, benthic invertebrates are not abundant and are not considered an important prey component for fish at the study area.

- Fish are accumulating compounds, specifically methyl-chlorophenoxy-propionic acid (MCPP), detected in study area sediments but not detected in reference sediments.

- There is a low potential risk to wildlife foraging on the media (sediment, surface water and fish) in the study area.

- There are a number of compounds without applicable sediment, surface water or tissue guidelines. Comparisons of study area concentrations to reference concentrations indicate a subset in concentrations in study area media that exceed the concentrations in reference media.

- In general, the impacts occur within 300 feet of the shoreline. All toxicity tests resulting in potential toxicity occurred within 150 feet of shore, with the exception of one station at 300 feet. This station is located downstream of a wing dam in an area where surface waters are more protected from strong currents.

- VOCs, SVOCs, and one herbicide are elevated at the surface water stations with toxicity, and VOCs and herbicides are elevated at the sediment stations with toxicity.

The field work related to the 2003 ecological risk assessment was conducted after the completion of the OU2 interim ROD. The 2003 assessment included sampling surface water and sediment and was divided into two sections – an aquatic risk assessment and a floodplain risk assessment. The aquatic risk assessment came to the conclusion that no adverse ecological impacts were associated with the presence of chemicals of potential ecological concern (COPECs) in sediments in the Mississippi River and that limited adverse impact was associated with COPECs in surface water. Surface water bioassays indicated that acute toxicity was limited to the sampling area downgradient of Site Q and just downstream of Site R. The two organic compounds identified as the principal constituents of concern in surface water in the Mississippi River adjacent to the Sauget Area 2 site were p-chloroaniline and 2,4-dichlorophenoxyacetic acid (2,4-D).

The floodplain risk assessment evaluated potential risks to piscivores, herbivores, carnivores and plants in the floodplain in the vicinity of the Sauget Area 2 site. The assessment identified the potential for significant ecological impacts associated with surface soil found at Site O and Site S. The most significant COPECs at Site O included dieldrin, lindane, PCBs, dioxins/furans, aluminum and mercury, and the most significant COPECs at Site S included PCP, beta-BHC, endrin, lindane, and PCBs.

A human health risk assessment for the Sauget Area 2 site was also performed. Evaluation of exposure and risk due to Sauget Area 2 showed that potential risks to human health due to direct contact, ingestion or dermal adsorption of landfilled materials; direct contact with surface water; inhalation of wind-blown dust; and inhalation of volatile organics from the landfill were all considered to be low. Even under worst-case exposure assumptions, the estimated excess lifetime carcinogenic risk for all of these pathways combined was 5.7×10^{-6}. With respect to noncarcinogenic hazards, the analysis indicated that the hazard indices for all receptor groups and pathways combined were less than one for realistic and worst-case exposure scenarios.

C. REMEDIAL ACTIONS

An interim ROD for operable unit 2 (OU2) was signed by USEPA in September 2002. This interim ROD presented an interim groundwater remedy to address the "release of contaminated groundwater into the Mississippi River at the Sauget Area 2 site in the vicinity of disposal Site R". Physical construction of the OU2 remedial action began in August 2003 and was completed in November 2005. Although there have been multiple removal actions at the Sauget Area 2 site, the interim remedy at Site R is the only CERCLA remedial action that has been conducted at Sauget Area 2. The focus of this five-year review is on the OU2 interim remedial action constructed adjacent to Site R.

Remedy Selection

The following remedial action objectives were identified for the interim groundwater remedial action:

- Protection of aquatic life in surface water and sediments from exposure to site contaminants;

- Prevention or abatement of actual or potential exposure to nearby human populations (including workers), animals or the food chain from hazardous substances, pollutants or contaminants;

- Prevention or abatement of actual or potential contamination of drinking water supplies and ecosystems;

- Achievement of acceptable chemical-specific contaminant levels, or range of levels, for all applicable exposure routes; and

- Mitigation or abatement of the release of contaminated groundwater in the plume area to the Mississippi River so that the impact is "insignificant" or "acceptable" as required by the May 3, 2000 W.G. Krummrich RCRA Administrative Order on Consent (AOC) (USEPA Docket No. R8H-5-00-003).

The selected interim remedy was chosen because it would greatly reduce the environmental impacts associated with the release of contaminated groundwater to the Mississippi River in the vicinity of Sauget Area 2 Site R. This was to be accomplished through the containment and extraction of contaminated groundwater downgradient of Sauget Area 2 Site R, thereby reducing mass loading to the Mississippi River. Reduction of mass loading would abate aquatic organism exposure to impacted groundwater, contamination of ecosystems, and sediment toxicity.

The major components of the interim groundwater remedy as described in the OU2 ROD are:

- **Physical Barrier** - A 3,500 foot long, "U"-shaped, fully penetrating, jet grouted barrier wall between the downgradient boundary of Sauget Area 2 Site R and the Mississippi River to abate the release of impacted groundwater.

- **Groundwater Extraction** - Three partially penetrating groundwater recovery wells, capable of pumping a combined total of 303 to 724 gallons per minute (gpm), inside the "U"-shaped barrier wall to abate groundwater moving to the wall.

- **Groundwater Treatment** - Once extracted, the contaminated groundwater is treated through the American Bottoms Regional Wastewater Treatment Facility (ABRTF) prior to being discharged to the Mississippi River.

- **Groundwater Quality Monitoring** - Groundwater sampling quarterly until the final groundwater remedy and associated groundwater monitoring program for the Sauget Area is in place.

- **Groundwater Level Monitoring** - Groundwater level monitoring would be done to ensure acceptable performance of the physical barrier.

- **Sediment and Surface Water Monitoring** - Sediment and surface water sampling in the plume release area to determine the effect of any contaminants migrating through, past or beneath the barrier wall and being released to the Mississippi River.

- **Institutional Controls** - Institutional controls would be used to limit fishing in the plume release area. Access to the Mississippi River in the plume release area is limited by existing fencing at Site R, a very steep riverbank and the absence of public roads leading to this area.

The interim ROD further stated that the gradient control achieved by the remedy would be determined by comparing water level elevations in pairs of fully penetrating piezometers that would be installed on both the inside and outside of the barrier wall. Pumping rates were to be adjusted so that the water level elevation in the inside piezometer was the same as the water level elevation in the outside piezometer. To supplement this gradient control information from the newly-installed piezometers, groundwater levels would also be measured on a quarterly basis in ten existing piezometers.

In July 2003, EPA signed an Explanation of Significant Differences (ESD) to modify the OU2 interim remedy. The ESD documented that a conventional soil-bentonite slurry barrier wall would be constructed instead of a jet grouted barrier wall. This change did not affect the scope of the interim remedy.

Remedy Implementation

The two main components of the remedial action called for in the OU2 interim ROD were the construction of the barrier wall and the installation of three groundwater recovery wells. The wall along with the extraction wells are referred to as the Groundwater Migration Control System, or GMCS. Although the three extraction wells are intended to be the principal groundwater control measure, the barrier wall serves to reduce the volume of groundwater flowing into the extraction system from the Mississippi River during operation of the extraction wells, thereby reducing operation and maintenance (O&M) costs by reducing the volume of water treated. Construction of the remedy began in 2003 and was completed in 2005.

Barrier Wall

Information on the completion of the wall and construction of the extraction wells that is presented below is from the draft Barrier Wall Completion Report, dated February 16, 2006. The draft report has been reviewed by USEPA and is currently being revised by the implementing PRPs.

The barrier wall is U-shaped and was constructed to form a separation between Site R and the Mississippi River (See Appendix B, Attachment 2, Figure 2). The total length is 3,273 feet. Vertically, the wall extends from about 3 feet below grade to the top of bedrock, which varies from 132 to 143 feet below grade. Approximately 2,000 feet of the length of the wall runs parallel to the river bank. The two "arms" of the U each extend approximately 650 feet eastward from the north and south sides of Site R. Instead of a jet-grouted design as planned in the OU2 interim ROD, the wall was excavated using the bentonite slurry method and was backfilled with

a design mixture of soil and bentonite. The barrier wall was designed to reduce recharge from the Mississippi River in the MHU and DHU and to act as a continuous barrier with minimal gaps. The draft Barrier Wall Completion Report stated that the average design permeability of the in-place wall was specified to be less than 1×10^{-7} centimeters per second (cm/sec) based on laboratory testing.

The slurry trench method of excavation consists of excavating a trench in the existing soils while at the same time keeping the trench filled with a bentonite-water slurry mixture. The slurry is displaced by backfill material as the wall is constructed. Bentonite is natural clay, and slurry is a stable, colloidal suspension of powdered bentonite in water. The backfill material is less permeable than the native material, resulting in a barrier that impedes groundwater flow.

In addition to bentonite and water, materials used for the barrier wall included naturally-deposited, on-site and off-site soils, imported borrow clay, and the in situ soils along the wall alignment. The mixture for the backfill was proportioned to provide a hydraulic conductivity of less than or equal to 1×10^{-7} cm/sec or lower when mixed to a homogenous consistency with the exception that 20 percent of the test specimens could have a permeability as high as 5×10^{-7} cm/sec and five percent of the test specimens could have permeability as high as 1×10^{-6} cm/sec. Non-toxic and biodegradable admixtures such as fluidifiers and retarders could have been used based on the design, but these were not needed. The actual backfill mix was determined by multiple laboratory compatibility tests and bench scale tests. On-site soil material for the backfill mix was excavated from the slurry trench and off-site soil material was brought to the site from an approved off-site source. The maximum allowable particle size in the backfill was 3 inches. Prior to pumping into the trench, the slurry was tested for the following parameters based on site conditions: percent bentonite (by weight), slurry unit weight, apparent viscosity, rate of filtrate loss, and pH. At a minimum, one quality assurance test of permeability and gradation testing of the prepared backfill was performed for every 3,000 cubic yards of backfill prepared and placed.

Nine notices of non-compliance were issued during the course of the construction of thebarrier wall. The notices related to backfill gradation samples, trench slurry viscosity samples, and trench slurry density samples that did not meet the specification requirements. Each of these issues were reviewed with USEPA and resolved.

One element of the barrier wall installation that required a modification to the design and impacted the completion schedule of the wall was the discovery of subgrade conditions that were unstable under construction loads. This was encountered when 20 feet thick of previously placed fly ash was discovered near the south end of the site. To address this problem, wick drains were installed throughout the unstable area. The drains allowed the perched water table to drain downward through a cemented fly ash layer into the lower sand layers.

Construction of the barrier wall generated spoils that were collected and transferred to a stockpile on top of Site R. The actual volume of the stockpile on top of Site R was surveyed and calculated to be 21,090 cubic yards. In addition, 17,585 cubic yards of spoils were spread along the inside of the slurry wall to promote drainage. The spoils adjacent to the barrier wall were covered with a minimum of 6 inches of topsoil and then seeded to form a vegetative cover.

Spoils were handled by different methods depending on which portion of the barrier wallwas being constructed. For the section of the barrier wall parallel to the river, the majority of the spoils were contained within a holding area constructed by building a berm between the landfill and the slurry wall. The area within the berm was low and formed an effective containment area for the spoils and excess slurry. Fluid spoils were hauled to temporary drying pits, after which the spoils were removed and trucked to the stockpile where they were placed and compacted. Drying pits were restricted to areas outside of the existing Site R landfill, but within the Site R property boundaries. The stockpile area was selected based upon access to the barrier wall construction activities, as well as the utilization of the clay cap material and topographic features of Site R. The perimeter of the stockpile was constructed of clean soil material imported from an off-site borrow source.

The filled spoils stockpile on top of Site R was covered with a clean soil leveling layer ollowed by a high-density polyethylene (HDPE) geomembrane cover. An additional clean soil layer was placed on top of the HDPE material and was seeded to form a vegetative layer.

On-site and imported fill materials were used to construct the cap over the barrier wall. A layer of 20 mil plastic sheeting and a reinforcement grid were installed to preserve the integrity of the barrier wall backfill and separate the cap material from the backfill. Drainage swales were constructed to the original grades.

Extraction Wells, Monitoring Wells and Piezometers

The other primary elements of the GMCS installed during the remedial action were the three extraction wells, twelve monitoring wells, and eight piezometers. The three extraction wells play a critical role in the GMCS by serving to reduce the volume of water flowing into the barrier wall. Each of the partially penetrating groundwater recovery wells has a maximum pumping capacity of between 700 and 750 gpm, which provides a total system capacity of about 2200 gpm. A total of twelve monitoring wells, in four three-well clusters, were installed downgradient of the physical barrier to determine mass loading to the Mississippi River resulting from any contaminants migrating through, past or beneath the barrier wall. Piezometer pairs – one on the upgradient side of the barrier wall and the other on the downgradient side of the barrier wall – were installed at least 200 feet apart at four locations. See Attachment 1, Figure 6, for locations of wells and piezometers and Attachment 3 for screened intervals of the wells and piezometers.

Over 1,000 feet of below-grade pipeline was installed to transfer water from the GMCS extraction wells to the American Bottoms Regional Wastewater Treatment Facility (ABRTF). The ABRTF is operated by the Village of Sauget and uses biodegradation and carbon adsorption systems to treat wastewater. The terminal point of the discharge pipeline from Site R is at two concrete manholes located at the northeast corner of the ABRTF Physical/Chemical Treatment (P-Chem) Plant property. An automatic water sample collection device is installed at the discharge vaults to collect and test the water prior to treatment. The total flow at the ABRTF discharge point is compared with the sum of the flows measured at the extraction wells every ten minutes. If the flow measurements differ by more than five percent, a leak alarm is triggered and the pumping is stopped.

GMCS Control Methodology

Interim Operating Period I began December 1, 2004 and ended February 28, 2005. Groundwater level, surface water level and pumping rate data collected during IOP I demonstrated that the GMCS could not be operated to achieve the ROD requirement for zero or inward gradient across the barrier wall under low river stage conditions even when pumping at maximum system capacity. Consequently, IOP II was conducted using groundwater flow into the barrier wall, computed using Darcy's Law, as a performance measure from August 1, 2005 through October 31, 2005. IOP II concluded that additional operational data were needed to optimize and simplify operation of the system. IOP III was conducted February 1, 2006 through May 31, 2006, in which results concluded the flow data obtained during IOP I, II, and III demonstrate that using Darcy's Law provides flow estimates that are very close to actual inflow. IOP IV was conducted from October 1, 2009 through February 15, 2010, to confirm the results for IOP III. Completion of IOP IV demonstrated that the GMCS meets System Convergence over 95% of the time over a wide range of river elevations and pumping rates. Since October 2009, the GMCS has operated as described in the IOP IV Work Plan (November 2009) and incorporated into the approved O & M Plan (May 2013).

APPENDIX B

Attachment 1 – Technical Memorandum, Summary of Performance Verification Monitoring Events at Site R, Sauget Area 2, Sauget, Illinois, Prepared for US EPA by CH2MHill, May 1, 2013

Attachment 2 – Figures
Figure 1 – Site Location
Figure 2 – Sauget Area 2 Sites
Figure 3 – Sauget Area 2 – Industrial Areas
Figure 4 – Plume Discharge Area

Attachment 3 – Ordinances for Village of Sauget and City of East St. Louis

Attachment 4 – Public Notice about Five-Year Review

Attachment 5 – Site Inspection Checklist

ATTACHMENT 1- TECHNICAL MEMORANDUM

Summary of Performance Verification Monitoring Events at Site R, Sauget Area 2, Sauget, IL

PREPARED FOR: USEPA

PREPARED BY: CH2M HILL

DATE: May 1, 2013

This technical memorandum provides a summary of field activities and results of the groundwater and surface water monitoring at Site R during the Quarterly Groundwater Monitoring Sampling Events from March 2008 through September 2012.

Summary of Field Activities

Performance verification sampling for the Site R Groundwater Migration Control System (GMCS) has included quarterly groundwater sampling and semi-annual surface water and sediment sampling since 2005. Sampling efforts and results are discussed in the following sections since the first five year review and for the period 2008 to 2012. Sampling has taken place in 2013, however, CH2M HILL has not received reports for 2013 results.

Quarterly Groundwater Sampling

Quarterly Groundwater Monitoring Sampling Events have been performed by Golder Associates Inc. on 12 barrier monitoring wells from June 2005 to the present (Figure 1). Sampling events from March 2008 through September 2012 are included in this evaluation and twenty Quarterly Groundwater Monitoring reports have been received by CH2M HILL for this period.

The monitoring wells were purged using low-flow techniques with an adjustable flow-rate down-hole pump and dedicated polyethylene tubing. Water quality parameters were evaluated in the field, including pH, temperature, specific conductivity, and turbidity. Each well was sampled following purging until the turbidity value decreased to less than 5 nephelometric turbidity units (NTU), or stabilization of field parameters was achieved for one hour, whichever occurred first. The samples were analyzed for VOCs, SVOCs, Herbicides, Pesticides, Metals, Total Organic Carbon (TOC), and Total Dissolved Solids (TDS).

The monitoring wells have been sampled on a quarterly basis over the period March 2008 through September 2012. Analytes detected in the groundwater samples have varied over time, but have consistently included detections of VOCs, SVOCs, pesticides, herbicides, and metals.

In order to show the trend over time for select constituents, logarithmic plots of concentration over time have been prepared. Figures 2, 3, 4, and 5 present the concentration over time for benzene, chlorobenzene, p-chloroaniline, and 1,4-dichlorobenzene for each hydrogeologic unit.

Groundwater Data Review

Quarterly groundwater sampling data have been collected since June 2005 for four sets of nested monitoring wells located between the barrier wall and the river. The compliance wells are labeled BWMW-1 through 4, with three vertical completions per well nest labeled shallow (S), middle (M) and deep (D). The groundwater samples are analyzed for:

- Volatile Organic Compounds (USEPA Method 8260B)
- Semi-Volatile Organic Compounds (USEPA Method 8270C)
- Organochlorine Pesticides (USEPA Method 8081A)
- Chlorinated Herbicides (USEPA Method 8151A)
- Total Organic Carbon (USEPA Method 9060)
- Mercury (USEPA Method 7470A)

- Metals (USEPA Method 6010B)
- Total Dissolved Solids (USEPA Method 160.1)

Most of the chemicals that exceed the compliance criteria are the organic compounds. Compliance criteria are the lower of the drinking water Maximum Contaminant Levels (MCLs) and the Aquatic Life Criteria (acute), Illinois General Use Derived Water Quality Criteria (Area 2 FS, Attachment 3). Four chemicals have been evaluated as indicator parameters to illustrate time-series trends and in those cases where there is a statistically significant decreasing trend, the time to achieve the regulatory criterion for a particular chemical. The four chemicals chosen as indicators include: benzene, chlorobenzene, 1,4-dichlorobenzene (1,4-DCB), and 4-chloroaniline.

A regression analysis was conducted on the twelve wells (4 locations and 3 depths per location) and the four indicator chemicals. The regression analysis looked at the following:

Comparison to the compliance criteria: the geometric mean of the last four measurements was used to reduce the effects of seasonal variation, for comparison to the compliance criteria.

Data set: use the entire record (June 2005 through December 2012) or is there a significant inflection (especially downward) that spans a multi-year period. In those cases where a significant downward inflection was observed, only the latter data was used in the regression.

Statistical significance: the significance of the goodness-of-fit of the regression was evaluated using a confidence level (α) of 95 percent.

Attenuation (decay) rate: the attenuation rate was estimated using a first-order decay model. Detected concentrations were transformed using the natural logarithm and plotted against time in years from the start of monitoring. The linear slope (when statistically significant) is equivalent to the decay rate in inverse years ($year^{-1}$).

Time to achieve compliance: the attenuation rates were used to forward estimate the time to achieve the compliance criterion is then estimated using the following:

$$t = \frac{\ln\left(\frac{C_{goal}}{C}\right)}{k}$$

Where:

t = time to achieve compliance criterion, years
C_{goal} = compliance criterion, µg/L
C = current concentration represented by the geometric mean of the last four measurements, µg/L
k = decay constant, $year^{-1}$

Table 1 summarizes the results of the regression analysis. In general, water quality changes over the period of record have been improving more quickly in the northern well group (BWMW-1) and the rates of decay lessen to the south. To illustrate, the following provides the range of times estimated to achieve compliance for the indicator parameters:

- BWMW-1: 0.24 – 51 years
- BWMW-2: 9.5 – 61 years
- BWMW-3: 2.3 – 71 years
- BWMW-4: 2.3 – 7.6 years (this is not representative, because most parameters showed no trend or increasing concentrations)

Most compounds exhibit stable or decreasing concentration trends. Increasing concentrations were observed at BWMW-3D for benzene and at BWMW-4D for 14DCB and chlorobenzene.

There are a number of limitations to this method of analysis. The most significant limitation is projecting forward based on historical data. The underlying basis is that the time-series trend will remain constant, which is unlikely, especially for aerobically degraded compounds. As aquifers return to aerobic conditions, decay rates will increase.

However, this analysis provides a rough estimate that groundwater restoration will likely require decades to occur.

Semi-annual Sediment and Surface Water Sampling

Semi-annual sediment and surface water sampling events have been performed by URS at five stations in the Mississippi River from September 2005 to the present. This memorandum provides an overview of sampling that has taken place from September 2008 through February 2012. From September 2008 to date (March 2013), five semi-annual sampling events have been performed, but reports have been received by CH2M HILL for only four events.

Sediment and surface water samples have been collected in sample locations adjacent to Site R to determine the concentrations over time of any contaminants migrating through, around, or potentially beneath the barrier wall and discharging into the Mississippi River. Under the Performance Standard Verification Plan (Volume 3 of the July 2003 GMCS Final Design Submittal), surface water and sediment samples were identified for collection at five locations designated as plume discharge area (PDA) -2, 3, 4, 5, and 9 (Figure 1, provided by URS). These five locations were chosen because toxicity was observed during the October/November 2000 sampling event by Menzie-Cura & Associates, Inc., which were summarized in an Ecological Risk Assessment (ERA) performed for the W.G. Krummrich Facility under USEPA RCRA jurisdiction; this ERA became a basis for the installation of the Site R GMCS and barrier wall.

Surface Water and Sediment Data Review

Sediment and surface water have been sampled on a semi-annual basis, since September 2005. Analytes detected in the sediment and surface water samples have varied over time, but have consistently included detections of VOCs, SVOCs, pesticides, herbicides, and metals. In order to show the trend over time for select consistuents, logarithmic plots of concentration over time have been prepared. Figure 6 depicts the trend over time in surface water data for the same constituents except 1,4-dichlorobenzene which had minimal detections. Figure 7 depicts the trend over time in sediment data for chlorobenzene, 1,2-dichlorobenzene, p-chloroaniline, 2,4-D, and 1,4-dichlorobenzene.

Results from sampling in September 2010 indicated high concentrations of chlorobenzene and p-chloroaniline in sediment samples collected from station PDA-2. USEPA instructed the PRPs to collect additional samples withint eh area of the higher concentrations and six additional sample locations were identified for the November 2010 sampling event. Of the six locations two could not be sampled due to obstructions at the locations. A total of four additional surface water and sediment samples were collected. Results from the additional sample locations indicated non-detect for chlorobenzene and p-chloroaniline in the additional samples.

TABLE 1

Sauget Area 2 Site R GMCS

Regression Analysis

Well	Chemical	MCL (µg/L)	WQC (µg/L)	Current Concentration (µg/L)	Concentration Exceeds Criterion?	Statistically Significant Trend?	Increasing or Decreasing?	Decay Rate as Half Life (yrs)	Time to Achieve Criterion (yrs)
BWMW-1S	1,4-Dichlorobenzene	75	1800	3.23	no	NA	NA	NA	NA
BWMW-1S	4-Chloroaniline	ns	2.4	31	YES	YES	Decreasing	4.1	15
BWMW-1S	Benzene	5	4200	217	YES	YES	Decreasing	1.3	7.1
BWMW-1S	Chlorobenzene	100	990	24,400	YES	YES	Decreasing	3.6	44
BWMW-1M	1,4-Dichlorobenzene	75	1800	25.5	no	NA	NA	NA	NA
BWMW-1M	4-Chloroaniline	ns	2.4	18.3	YES	YES	Decreasing	1.1	3.3
BWMW-1M	Benzene	5	4200	30.5	YES	YES	Decreasing	3.2	8.4
BWMW-1M	Chlorobenzene	100	990	2,720	YES	YES	Decreasing	2.7	24
BWMW-1D	1,4-Dichlorobenzene	75	1800	4.98	no	NA	NA	NA	NA
BWMW-1D	4-Chloroaniline	ns	2.4	5.11	YES	YES	Decreasing	1.5	1.6
BWMW-1D	Benzene	5	4200	5.36	YES	YES	Decreasing	2.3	0.24
BWMW-1D	Chlorobenzene	100	990	2,930	YES	YES	Decreasing	5.6	51
BWMW-2S	1,4-Dichlorobenzene	75	1800	1.45	no	NA	NA	NA	NA
BWMW-2S	4-Chloroaniline	ns	2.4	62.9	YES	YES	Decreasing	2	9.5
BWMW-2S	Benzene	5	4200	3.71	no	NA	NA	NA	NA
BWMW-2S	Chlorobenzene	100	990	165	YES	YES	Decreasing	4.5	23
BWMW-2M	1,4-Dichlorobenzene	75	1800	69.9	no	NA	NA	NA	NA
BWMW-2M	4-Chloroaniline	ns	2.4	1,120	YES	YES	Decreasing	3.3	29
BWMW-2M	Benzene	5	4200	390	YES	YES	Decreasing	9.7	61

TABLE 1

Sauget Area 2 Site R GMCS

Regression Analysis

Well	Chemical	MCL (µg/L)	WQC (µg/L)	Current Concentration (µg/L)	Concentration Exceeds Criterion?	Statistically Significant Trend?	Increasing or Decreasing?	Decay Rate as Half Life (yrs)	Time to Achieve Criterion (yrs)
BWMW-2M	Chlorobenzene	100	990	2,120	YES	YES	Decreasing	4.1	35
BWMW-2D	1,4-Dichlorobenzene	75	1800	411	YES	YES	Increasing	NA	NA
BWMW-2D	4-Chloroaniline	ns	2.4	35,100	YES	no	NA	NA	NA
BWMW-2D	Benzene	5	4200	716	YES	no	NA	NA	NA
BWMW-2D	Chlorobenzene	100	990	3,820	YES	YES	Decreasing	9.7	93
BWMW-3S	1,4-Dichlorobenzene	75	1800	4.43	no	NA	NA	NA	NA
BWMW-3S	4-Chloroaniline	ns	2.4	7.55	YES	YES	Decreasing	3.2	5.3
BWMW-3S	Benzene	5	4200	11.9	YES	YES	Decreasing	1.8	2.3
BWMW-3S	Chlorobenzene	100	990	172	YES	YES	Decreasing	5.9	30
BWMW-3M	1,4-Dichlorobenzene	75	1800	35.6	no	NA	NA	NA	NA
BWMW-3M	4-Chloroaniline	ns	2.4	950	YES	no	NA	NA	NA
BWMW-3M	Benzene	5	4200	304	YES	No	NA	NA	NA
BWMW-3M	Chlorobenzene	100	990	3,710	YES	YES	Decreasing	7.5	71
BWMW-3D	1,4-Dichlorobenzene	75	1800	51.5	no	NA	NA	NA	NA
BWMW-3D	4-Chloroaniline	ns	2.4	4,150	YES	no	NA	NA	NA
BWMW-3D	Benzene	5	4200	205	YES	YES	Increasing	NA	NA
BWMW-3D	Chlorobenzene	100	990	2,660	YES	no	NA	NA	NA
BWMW-4S	1,4-Dichlorobenzene	75	1800	1.44	no	NA	NA	NA	NA
BWMW-4S	4-Chloroaniline	ns	2.4	6.59	YES	no	NA	NA	NA

TABLE 1

Sauget Area 2 Site R GMCS

Regression Analysis

Well	Chemical	MCL (µg/L)	WQC (µg/L)	Current Concentration (µg/L)	Concentration Exceeds Criterion?	Statistically Significant Trend?	Increasing or Decreasing?	Decay Rate as Half Life (yrs)	Time to Achieve Criterion (yrs)
BWMW-4S	Benzene	5	4200	0.0877	no	NA	NA	NA	NA
BWMW-4S	Chlorobenzene	100	990	9.4	YES	no	NA	NA	NA
BWMW-4M	1,4-Dichlorobenzene	75	1800	12.7	no	NA	NA	NA	NA
BWMW-4M	4-Chloroaniline	ns	2.4	16.1	YES	YES	Decreasing	0.85	2.3
BWMW-4M	Benzene	5	4200	1.3	no	NA	NA	NA	NA
BWMW-4M	Chlorobenzene	100	990	153	YES	YES	Decreasing	1.5	7.6
BWMW-4D	1,4-Dichlorobenzene	75	1800	159	YES	YES	Increasing	NA	NA
BWMW-4D	4-Chloroaniline	ns	2.4	2,040	YES	no	NA	NA	NA
BWMW-4D	Benzene	5	4200	33.3	YES	no	NA	NA	NA
BWMW-4D	Chlorobenzene	100	990	1,360	YES	YES	Increasing	NA	NA

Footnotes:

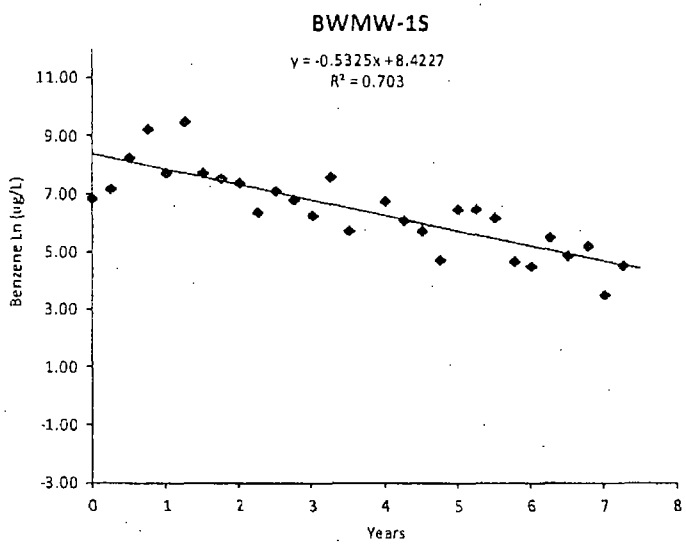
MCL Maximum Contaminant Level

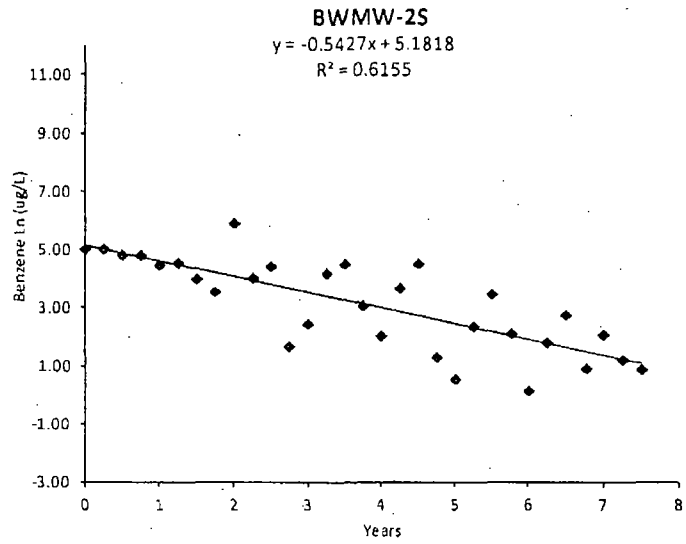
WQC Aquatic Life Criteria (acute), Illinois General Use Derived Water Quality Criteria (Area 2 FS, Attachment 3)

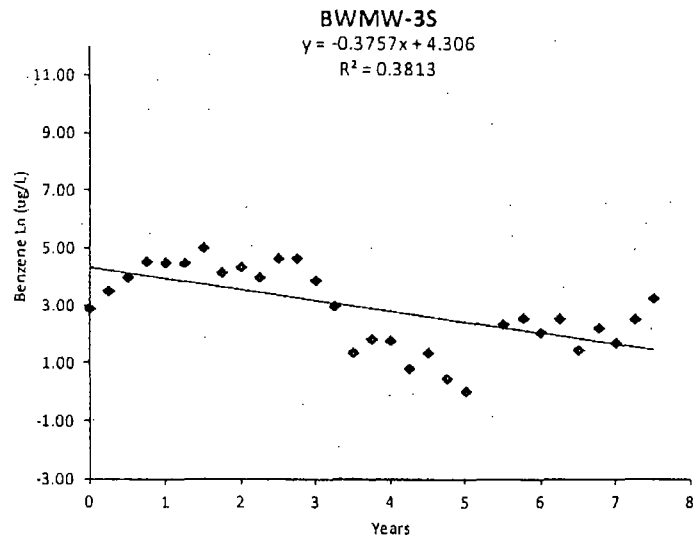
Current Concentration: geometric mean of the last four sampling events to 3 significant figures

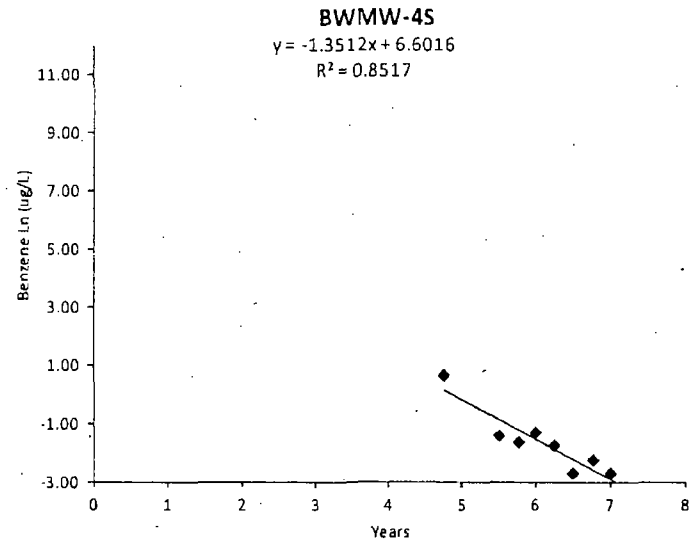
ns no standard

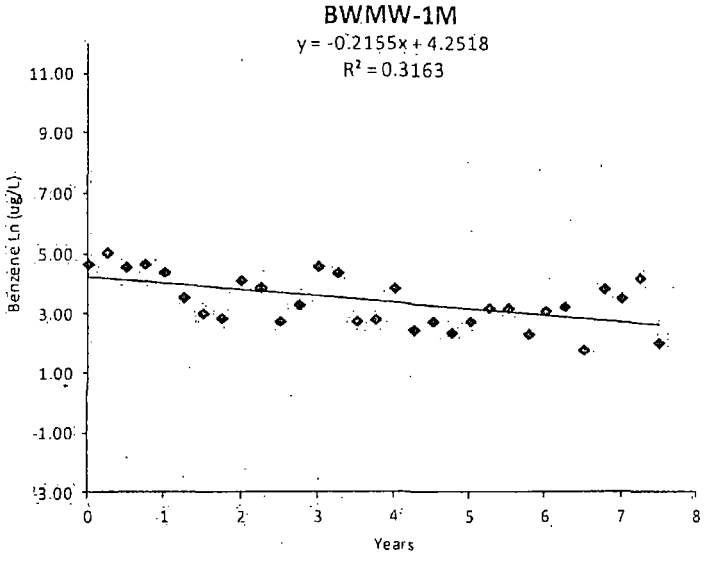
NA not applicable

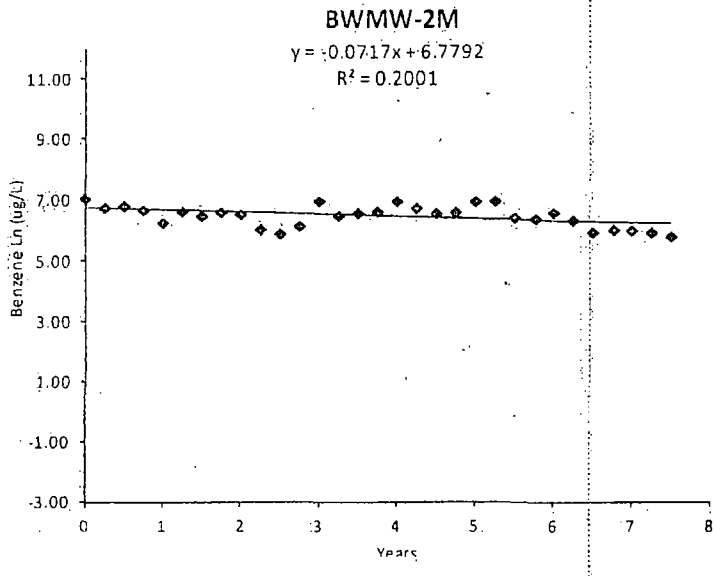

BWMW-1S
y = -0.5325x + 8.4227
R² = 0.703
Benzene Ln (ug/L)
Years

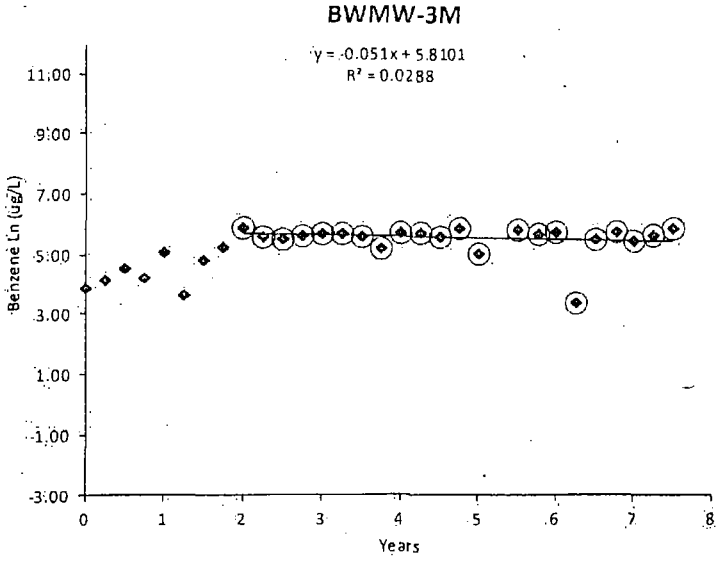

BWMW-2S
y = -0.5427x + 5.1818
R² = 0.6155
Benzene Ln (ug/L)
Years

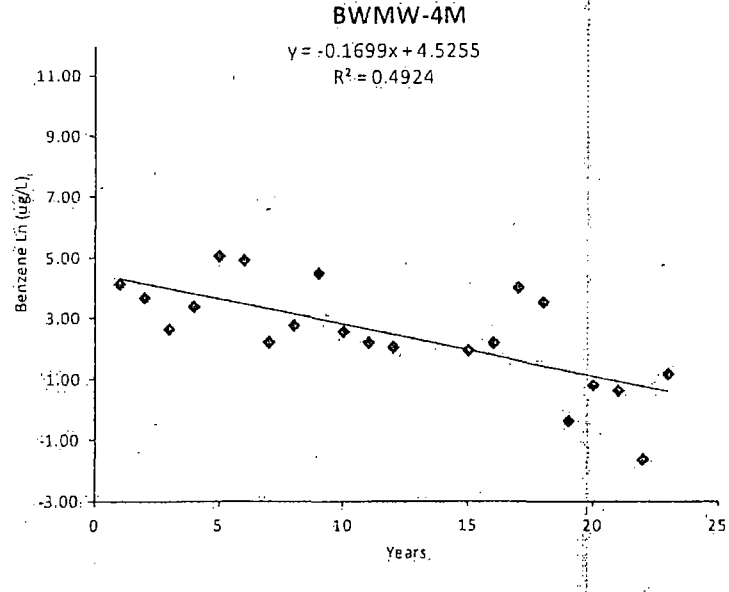

BWMW-3S
y = -0.3757x + 4.306
R² = 0.3813
Benzene Ln (ug/L)
Years

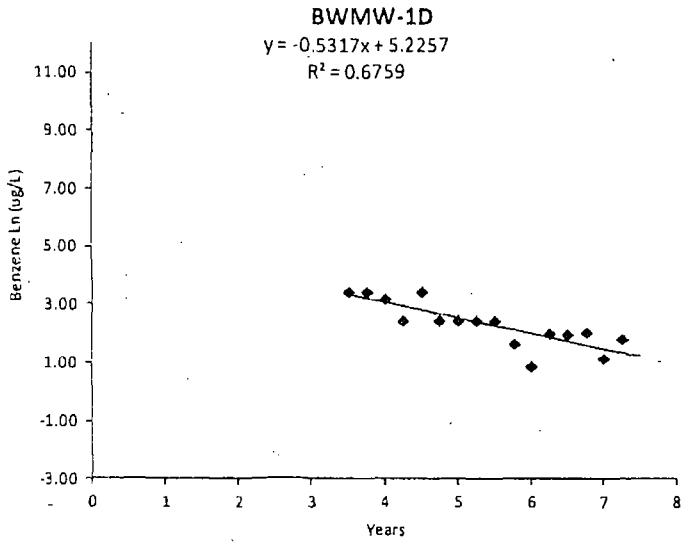

BWMW-4S
y = -1.3512x + 6.6016
R² = 0.8517
Benzene Ln (ug/L)
Years

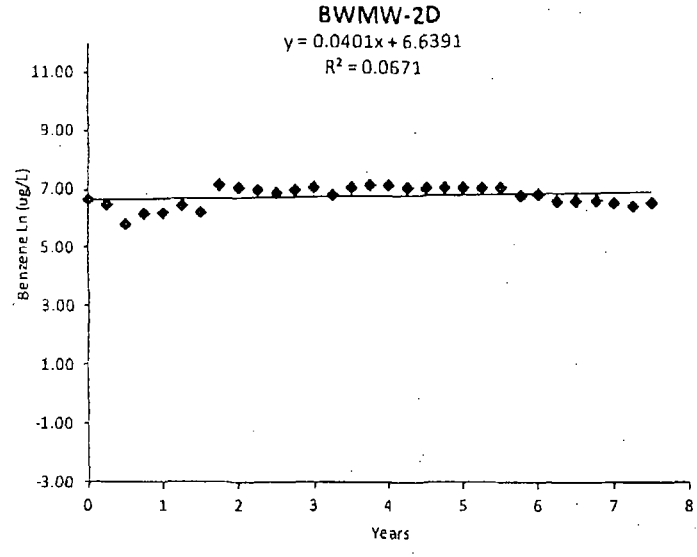

BWMW-1M
y = -0.2155x + 4.2518
R² = 0.3163
Benzene Ln (ug/L)
Years

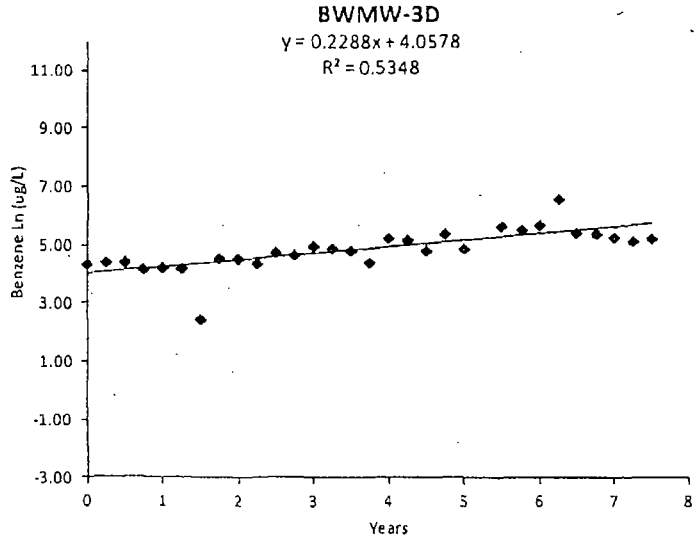

BWMW-2M
y = -0.0717x + 6.7792
R² = 0.2001
Benzene Ln (ug/L)
Years

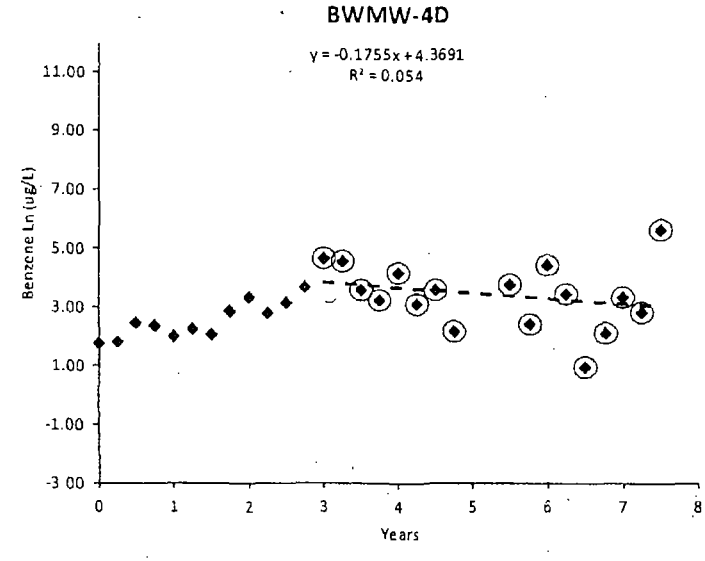

BWMW-3M
y = -0.051x + 5.8101
R² = 0.0288
Benzene Ln (ug/L)
Years

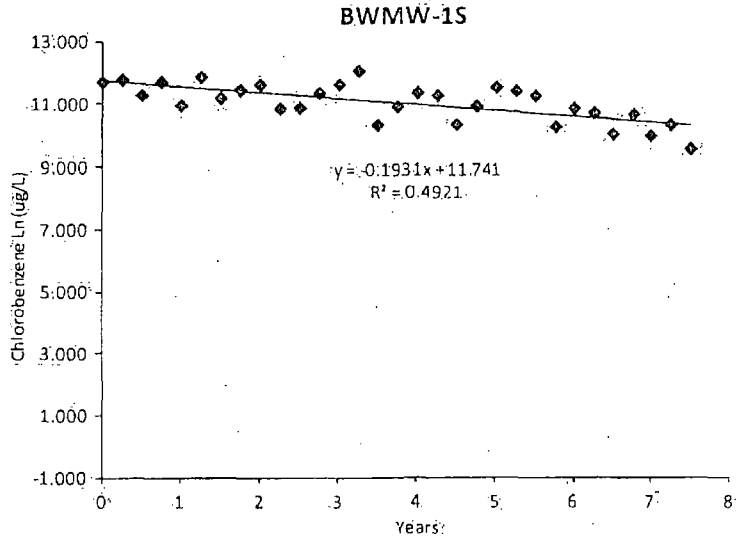

BWMW-4M
y = -0.1699x + 4.5255
R² = 0.4924
Benzene Ln (ug/L)
Years

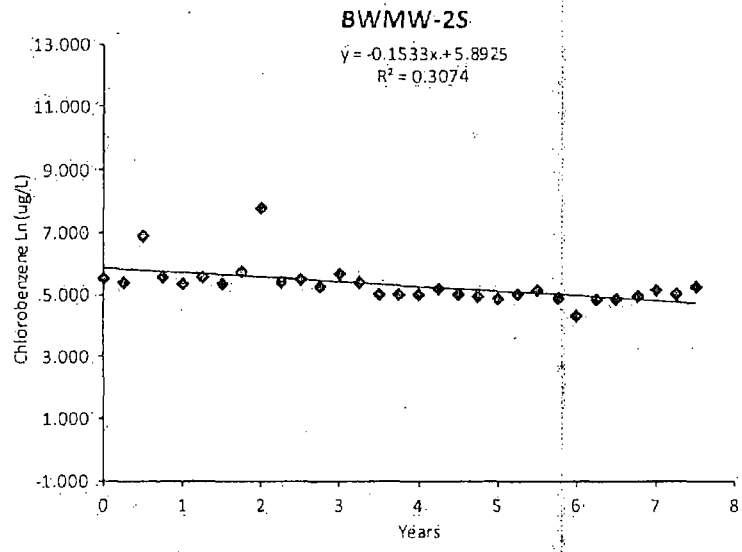

BWMW-1D
y = -0.5317x + 5.2257
R² = 0.6759
Benzene Ln (ug/L)
Years


BWMW-2D
y = 0.0401x + 6.6391
R² = 0.0671
Benzene Ln (ug/L)
Years


BWMW-3D
y = 0.2288x + 4.0578
R² = 0.5348
Benzene Ln (ug/L)
Years


BWMW-4D
y = -0.1755x + 4.3691
R² = 0.054
Benzene Ln (ug/L)
Years


BWMW-1S
y = -0.1931x + 11.741
R² = 0.4921
Chlorobenzene Ln (ug/L)
Years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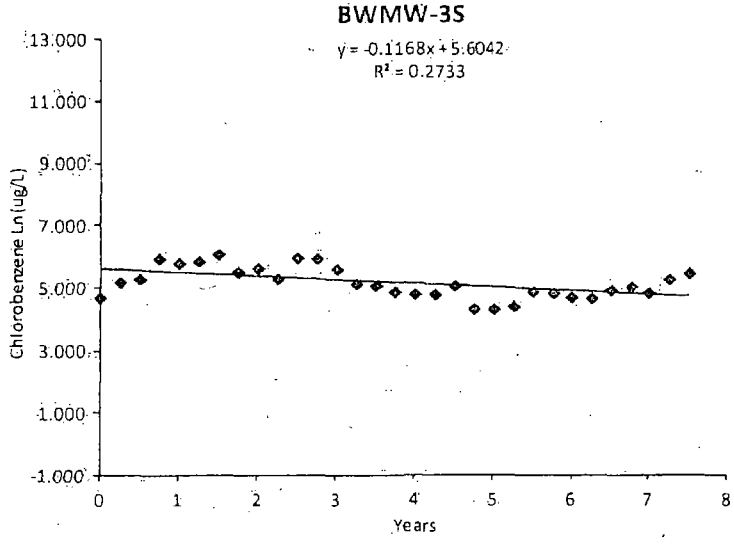
R² = 0.3074
Chlorobenzene Ln (ug/L)
Years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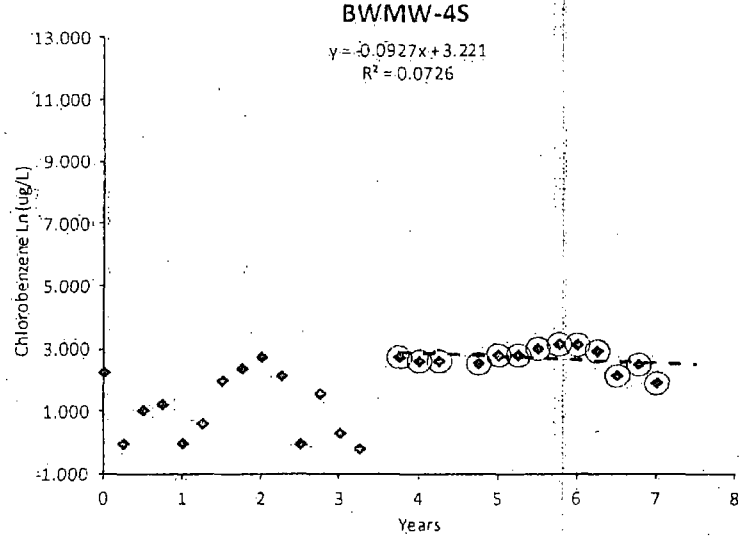
R² = 0.2733
Chlorobenzene Ln (ug/L)
Years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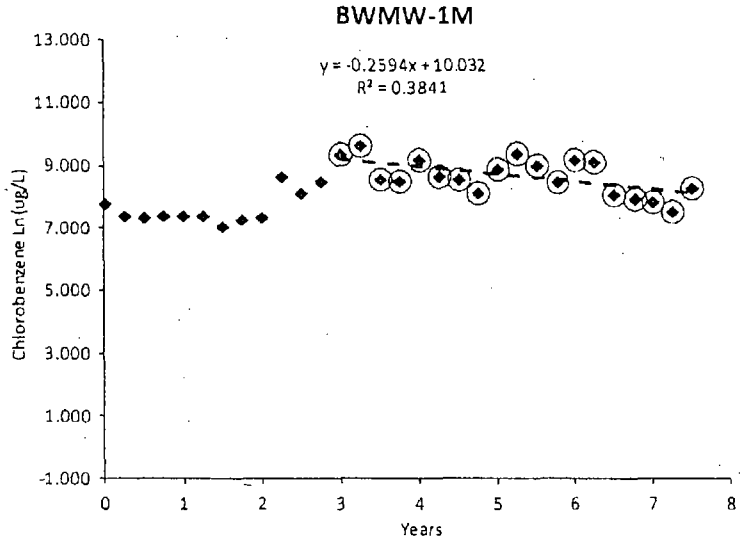
Chlorobenzene Ln (ug/L)
Years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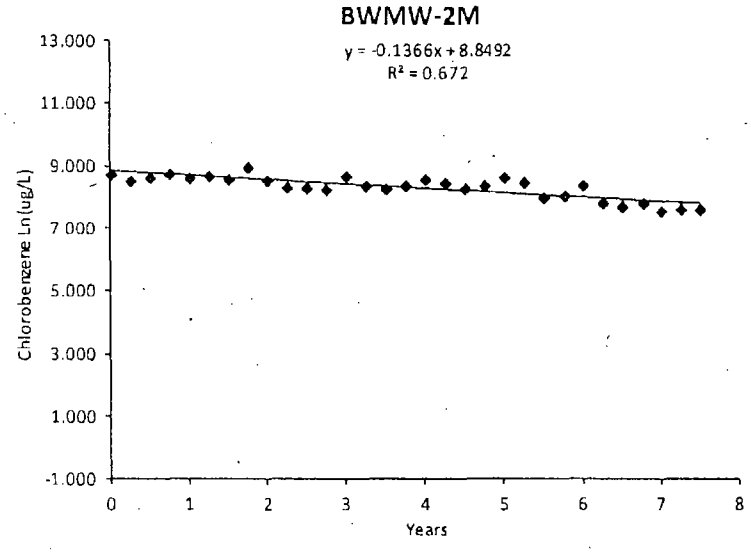
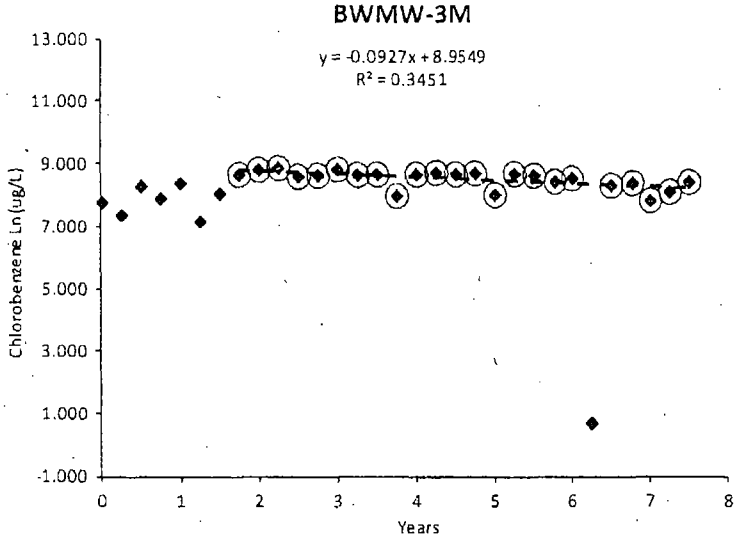
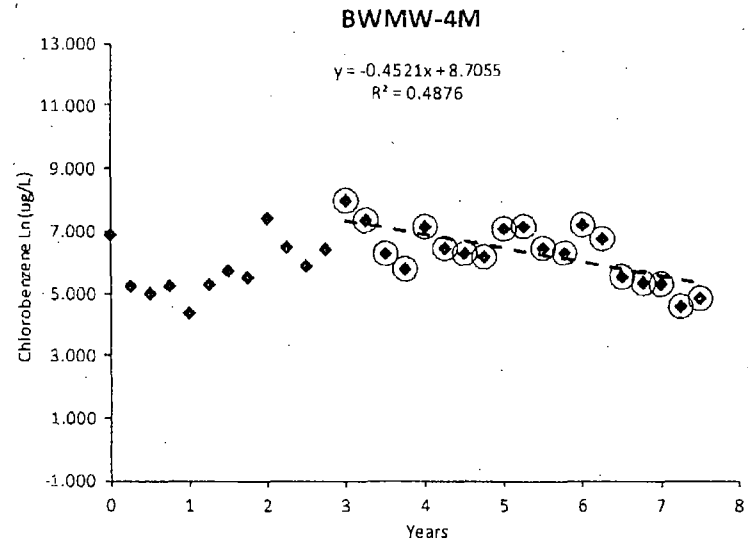
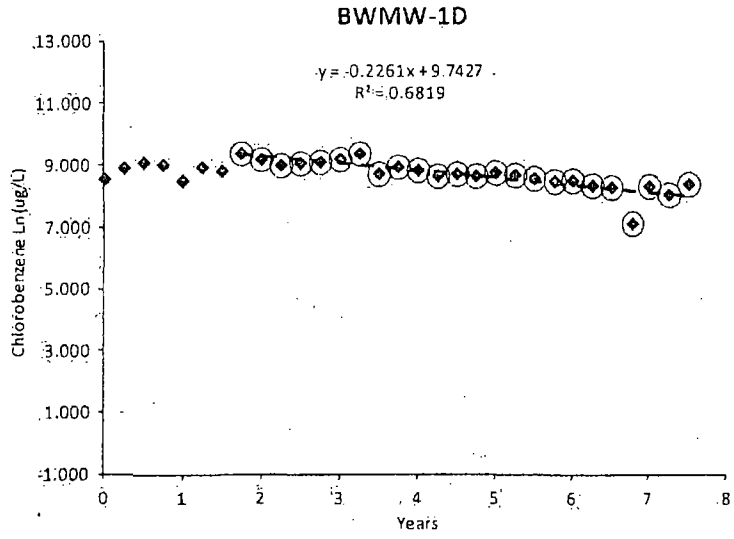
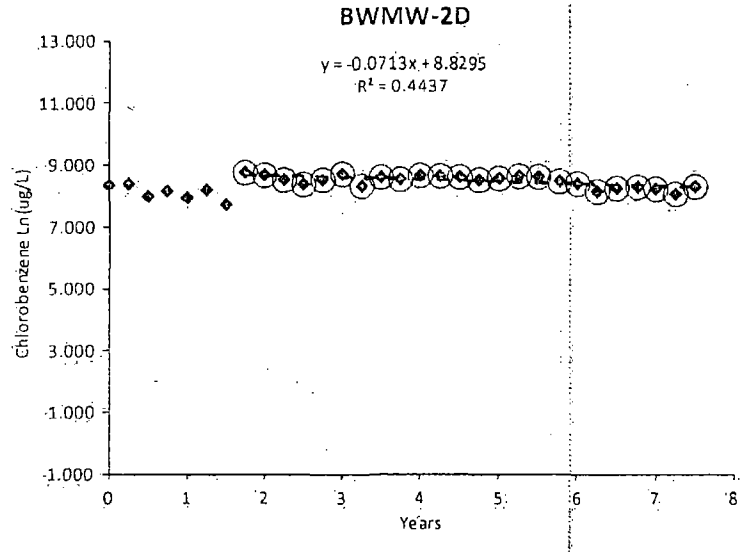
y = -0.2594x + 10.032
R² = 0.3841
Chlorobenzene Ln (ug/L)
13.000
11.000
9.000
7.000
5.000
3.000
1.000
-1.000
0
1
2
3
4
5
6
7
8
Years

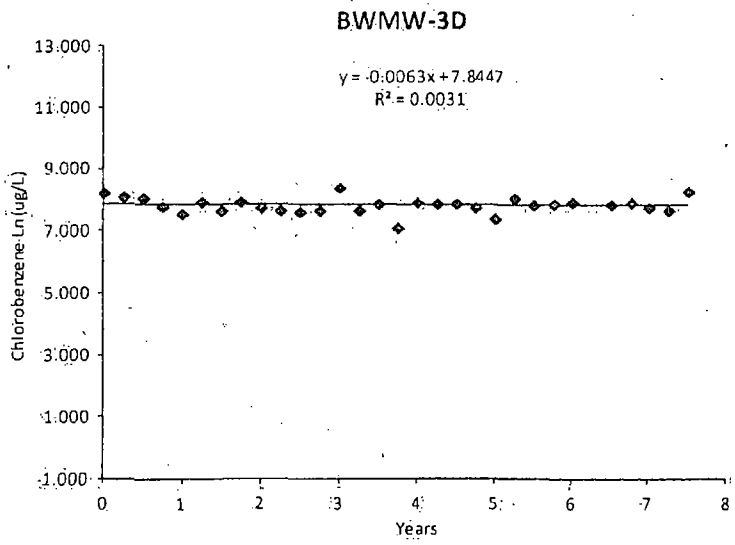

BWMW-2M
y = -0.1366x + 8.8492
R² = 0.672
Chlorobenzene Ln (ug/L)
13.000
11.000
9.000
7 000
5.000
3.000
1.000
-1.000
0
1
2
3
4
5
6
7
8
Years

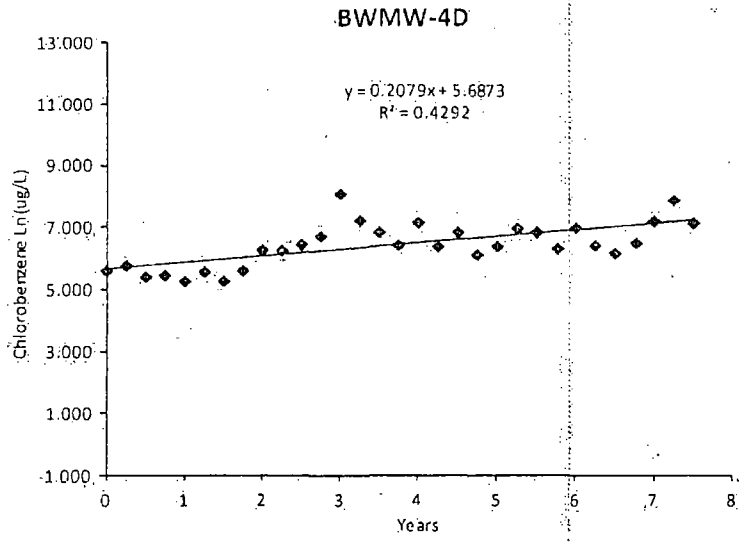

BWMW-3M
y = -0.0927x + 8.9549
R² = 0.3451
Chlorobenzene Ln (ug/L)
13.000
11.000
9.000
7.000
5.000
3.000
1.000
-1.000
0
1
2
3
4
5
6
7
8
Years

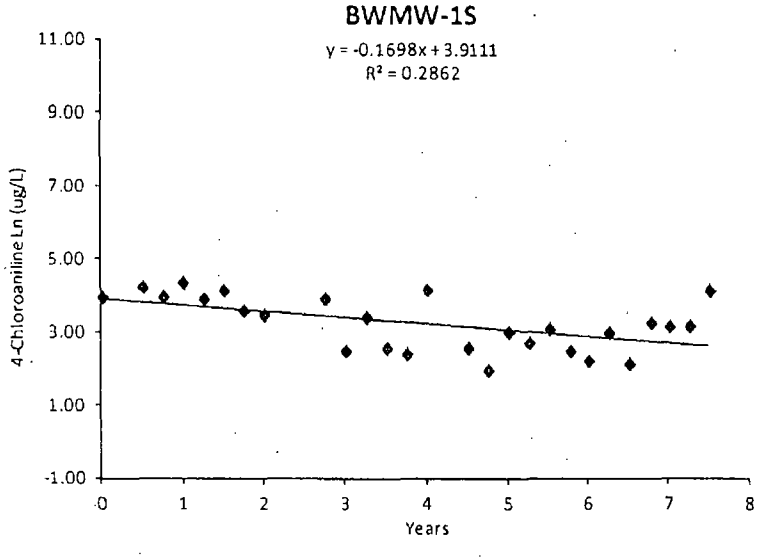

BWMW-4M
y = -0.4521x + 8.7055
R² = 0.4876
Chlorobenzene Ln (ug/L)
13.000
11.000
9.000
7.000
5.000
3.000
1.000
-1.000
0
1
2
3
4
5
6
7
8
Years

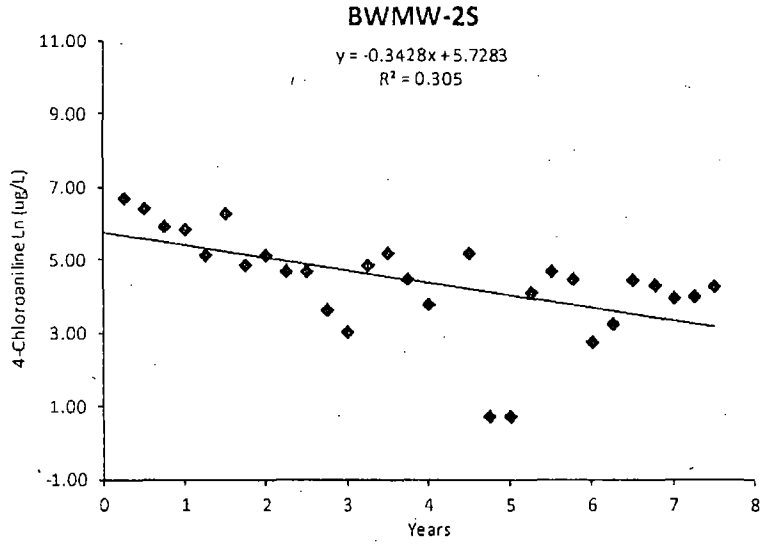

BWMW-1D
y = -0.2261x + 9.7427
R² = 0.6819
Chlorobenzene Ln (ug/L)
Years

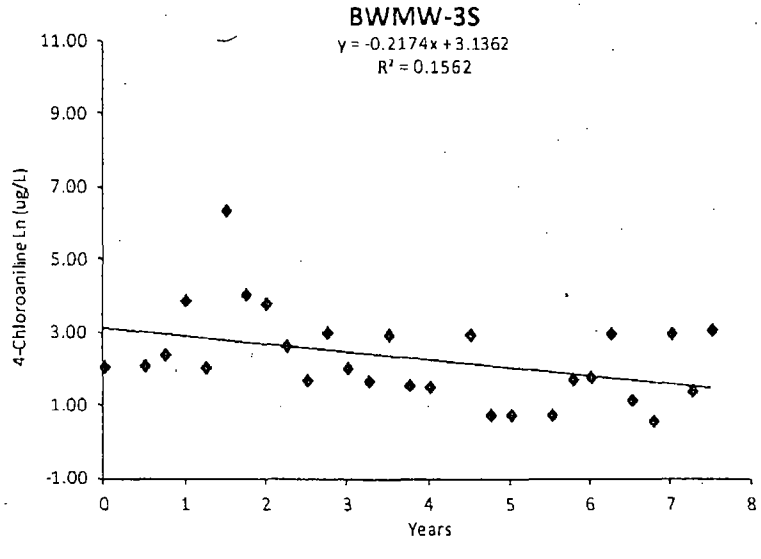

BWMW-2D
y = -0.0713x + 8.8295
R² = 0.4437
Chlorobenzene Ln (ug/L)
Years

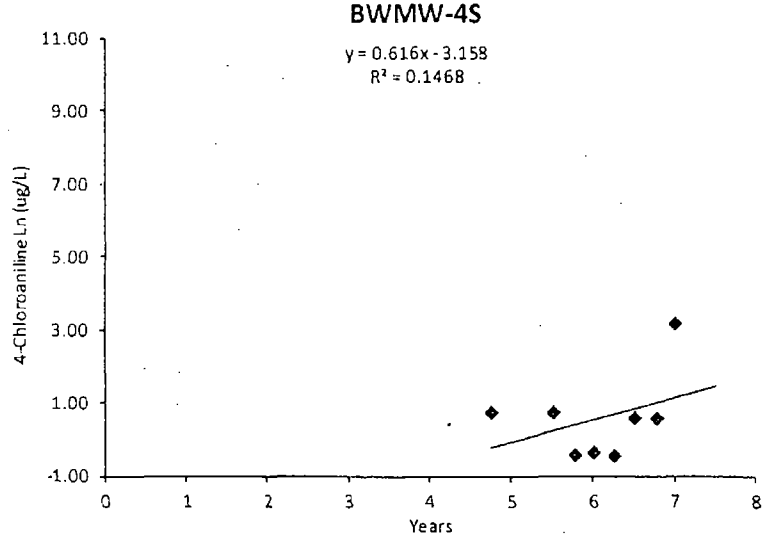

BWMW-3D
y = -0.0063x + 7.8447
R² = 0.0031
Chlorobenzene Ln (ug/L)
Years

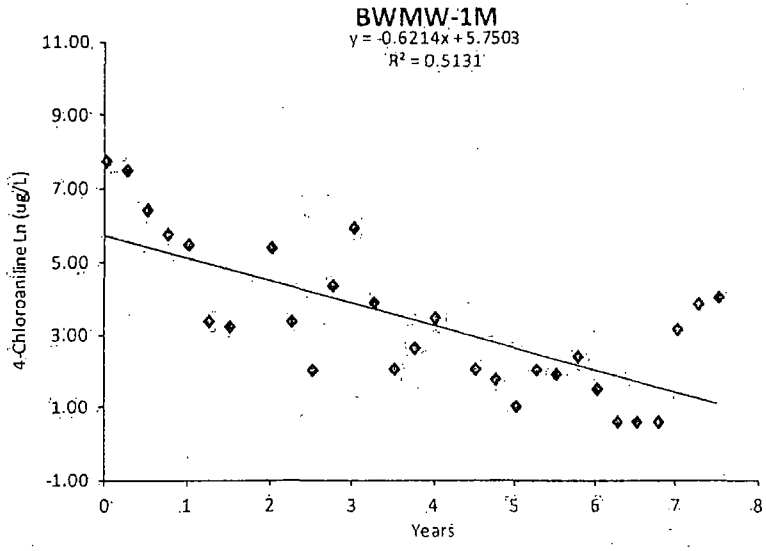

BWMW-4D
y = 0.2079x + 5.6873
R² = 0.4292
Chlorobenzene Ln (ug/L)
Years

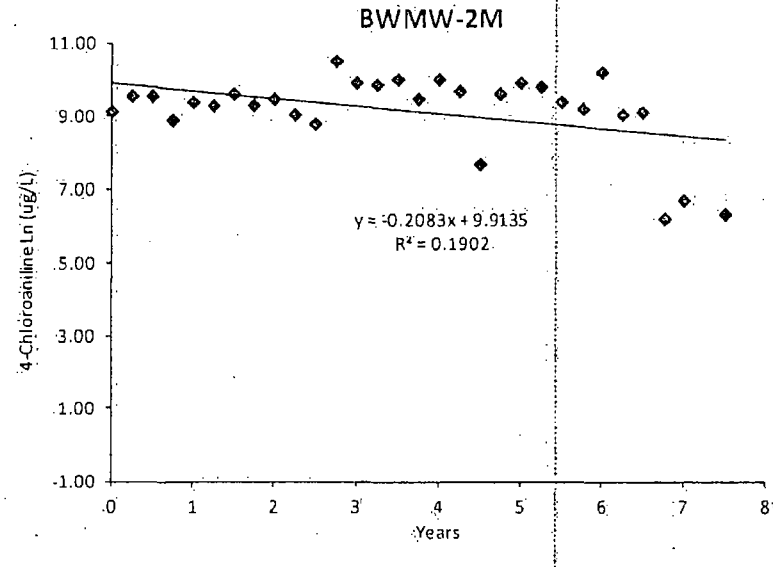

BWMW-1S
y = -0.1698x + 3.9111
R² = 0.2862
4-Chloroaniline Ln (ug/L)
Years

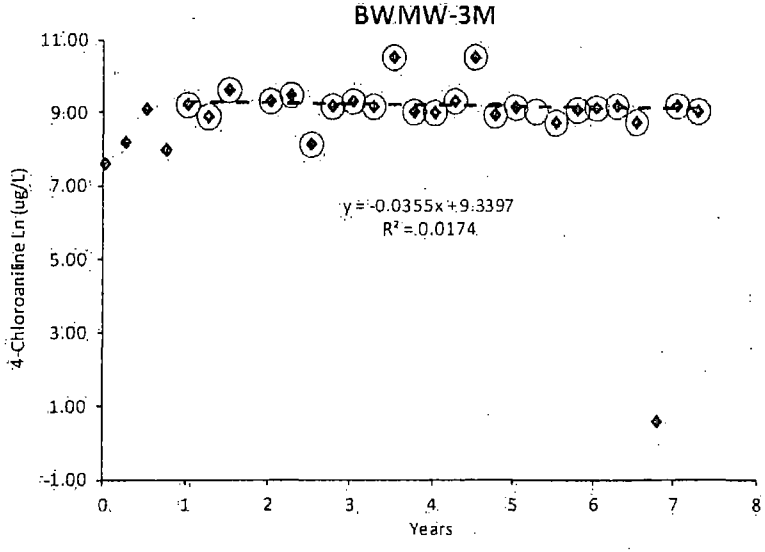

BWMW-2S
y = -0.3428x + 5.7283
R² = 0.305
4-Chloroaniline Ln (ug/L)
Years

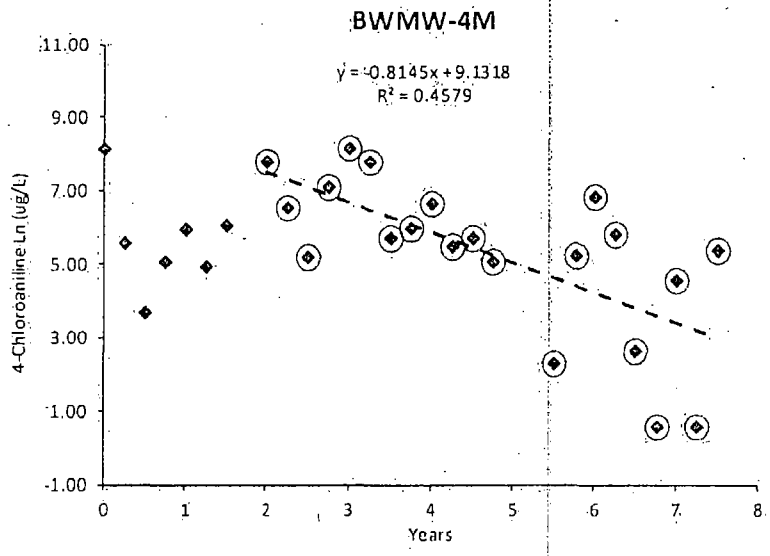

BWMW-3S
y = -0.2174x + 3.1362
R² = 0.1562
4-Chloroaniline Ln (ug/L)
Years

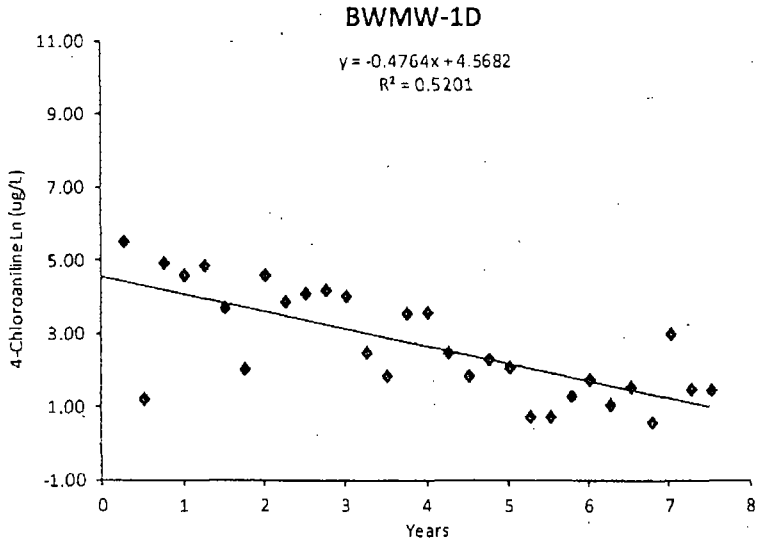

BWMW-4S
y = 0.616x - 3.158
R² = 0.1468
4-Chloroaniline Ln (ug/L)
Years

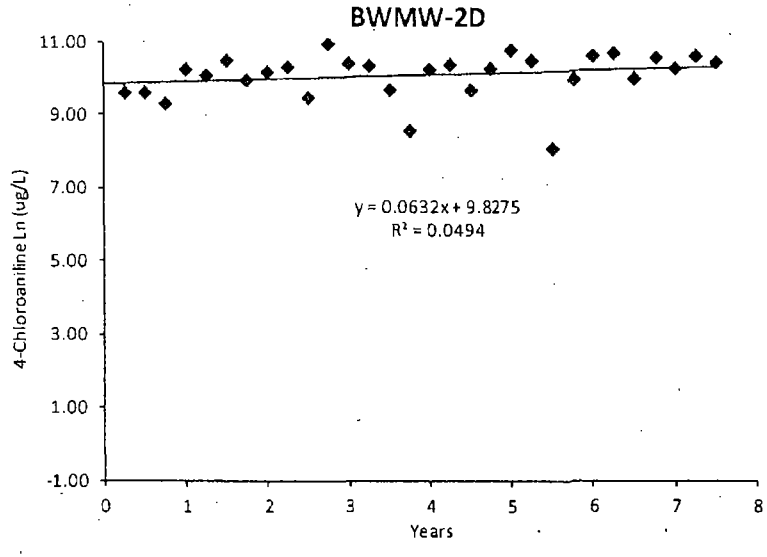

BWMW-1M
y = -0.6214x + 5.7503
R² = 0.5131
4-Chloroaniline Ln (ug/L)
Years

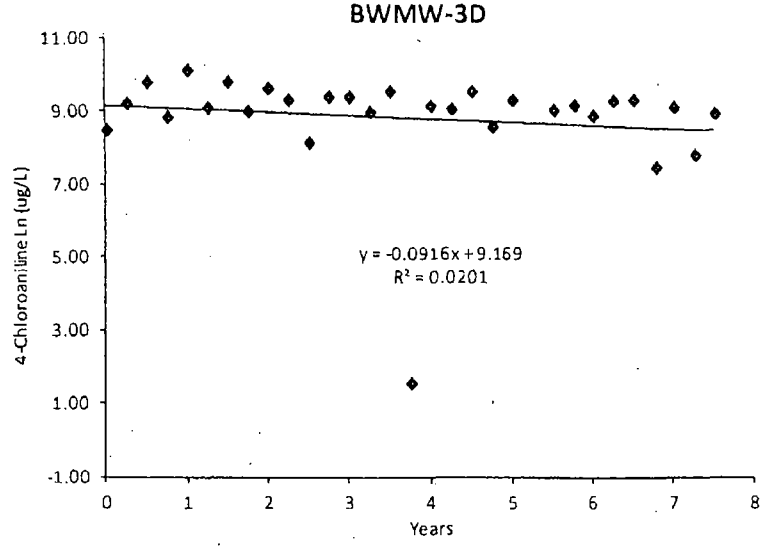

BWMW-2M
y = -0.2083x + 9.9135
R² = 0.1902
4-Chloroaniline Ln (ug/L)
Years

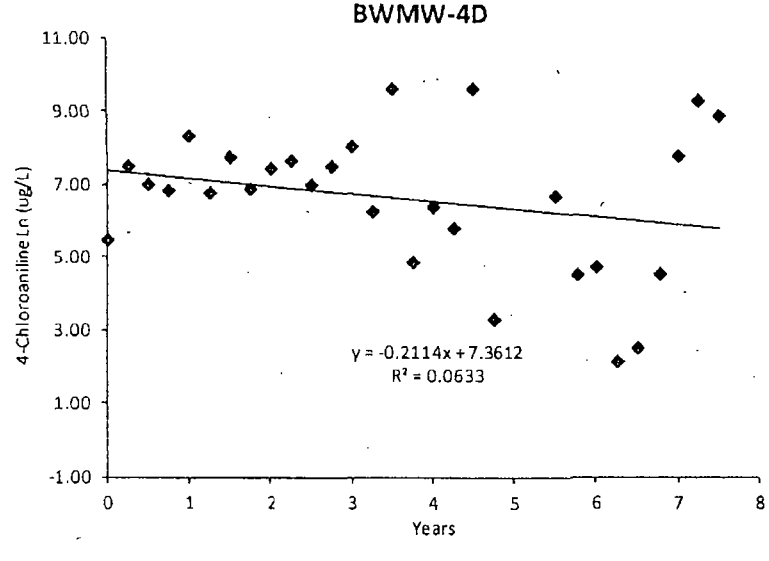

BWMW-3M
y = -0.0355x + 9.3397
R² = 0.0174
4-Chloroaniline Ln (ug/L)
Years

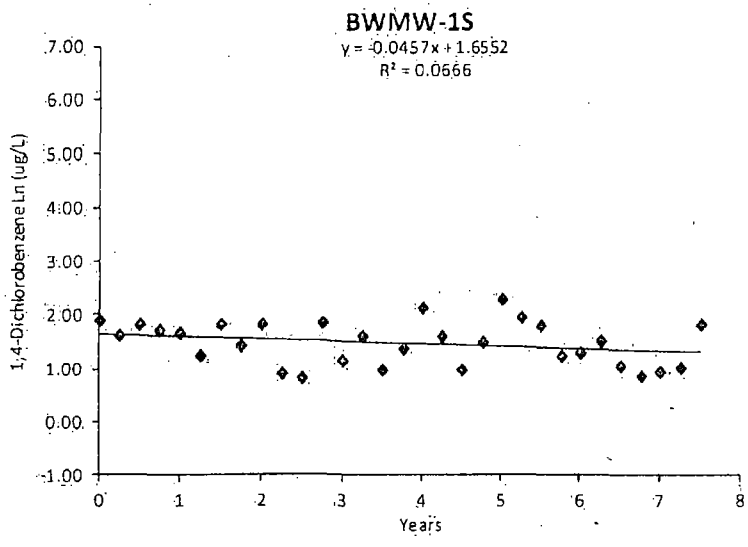

BWMW-4M
y = -0.8145x + 9.1318
R² = 0.4579
4-Chloroaniline Ln (ug/L)
Years

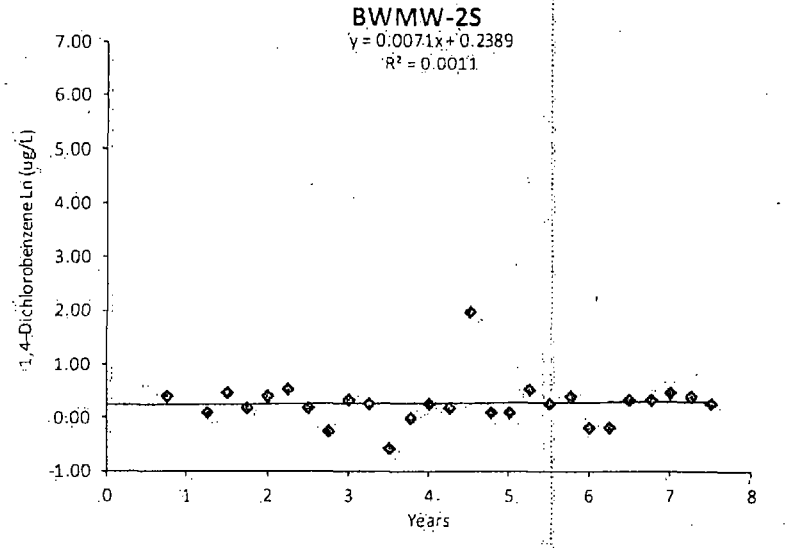

BWMW-1D
y = -0.4764x + 4.5682
R² = 0.5201
4-Chloroaniline Ln (ug/L)
Years

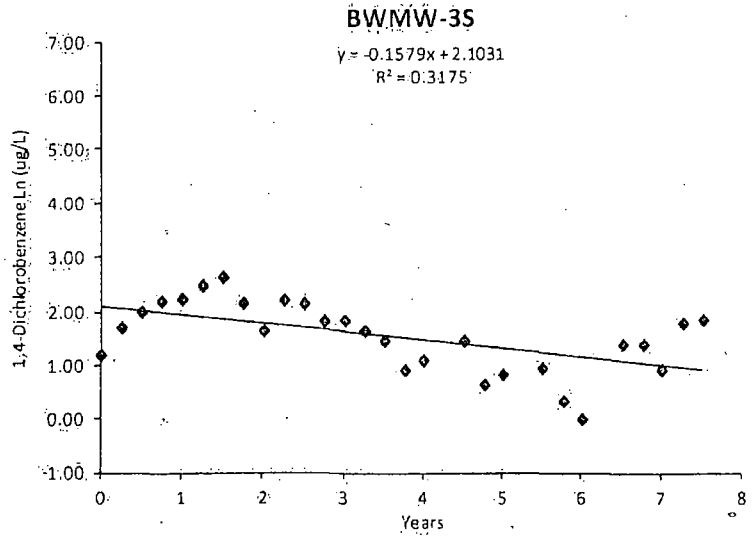

BWMW-2D
y = 0.0632x + 9.8275
R² = 0.0494
4-Chloroaniline Ln (ug/L)
Years

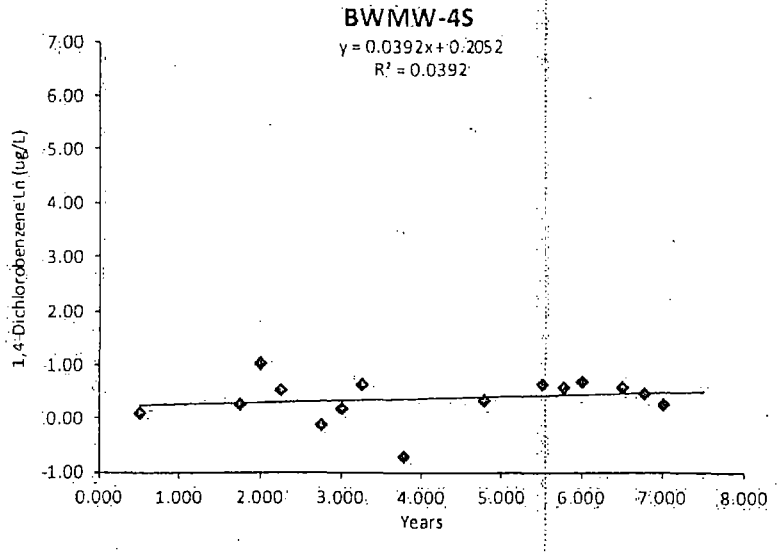

BWMW-3D
y = -0.0916x + 9.169
R² = 0.0201
4-Chloroaniline Ln (ug/L)
Years

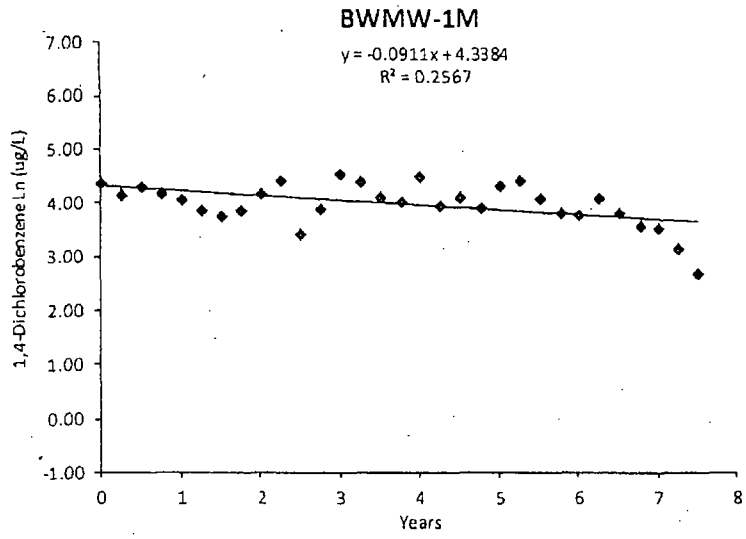

BWMW-4D
y = -0.2114x + 7.3612
R² = 0.0633
4-Chloroaniline Ln (ug/L)
Years

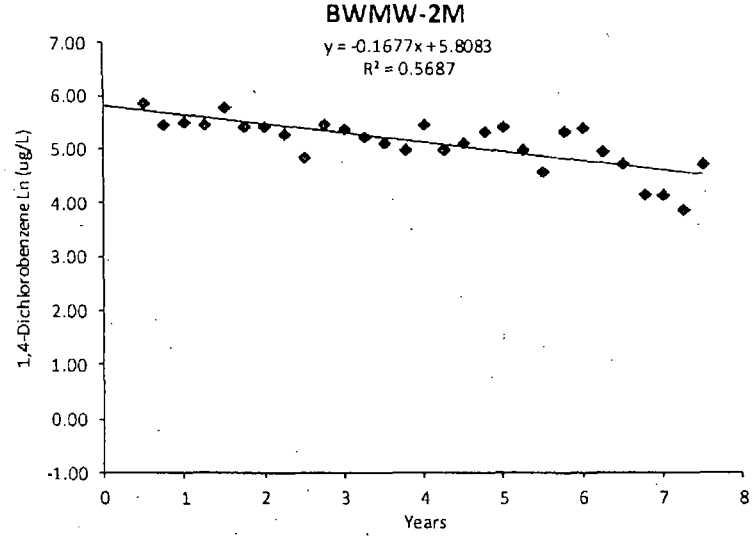

BWMW-1S
y = -0.0457x + 1.6552
R² = 0.0666
1,4-Dichlorobenzene Ln (ug/L)
Years

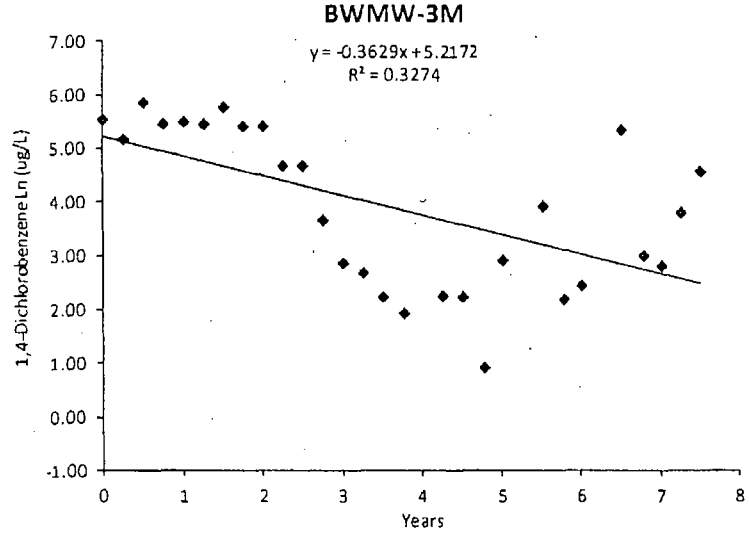

BWMW-2S
y = 0.0071x + 0.2389
R² = 0.0011
1,4-Dichlorobenzene Ln (ug/L)
Years

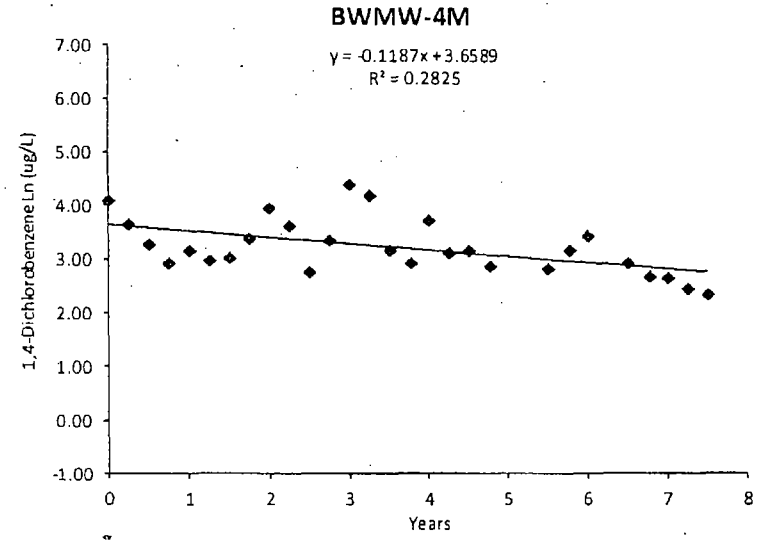

BWMW-3S
y = -0.1579x + 2.1031
R² = 0.3175
1,4-Dichlorobenzene Ln (ug/L)
Years

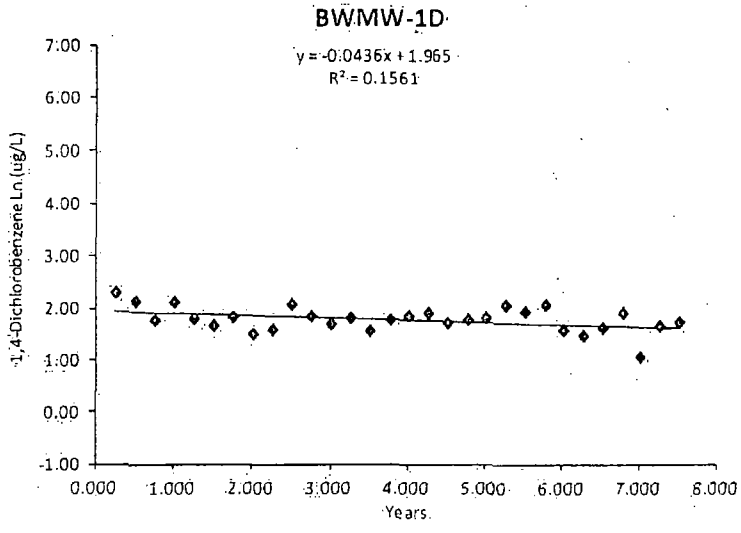

BWMW-4S
y = 0.0392x + 0.2052
R² = 0.0392
1,4-Dichlorobenzene Ln (ug/L)
Years

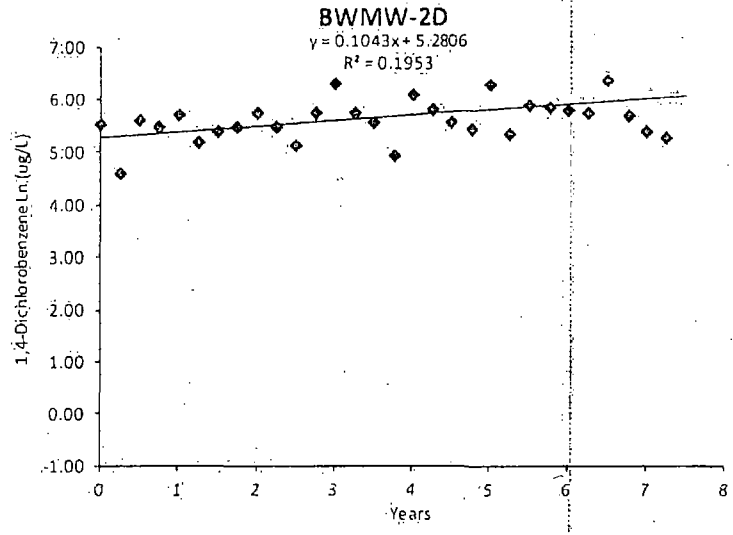

BWMW-1M
y = -0.0911x + 4.3384
R² = 0.2567
1,4-Dichlorobenzene Ln (ug/L)
Years

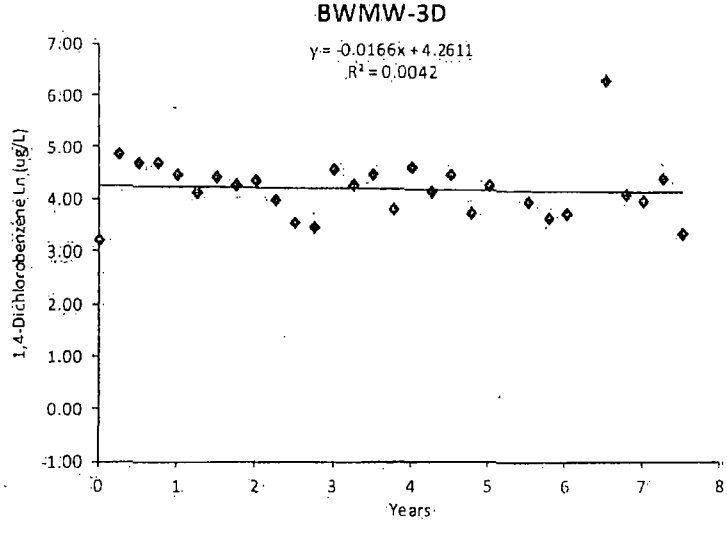

BWMW-2M
y = -0.1677x + 5.8083
R² = 0.5687
1,4-Dichlorobenzene Ln (ug/L)
Years

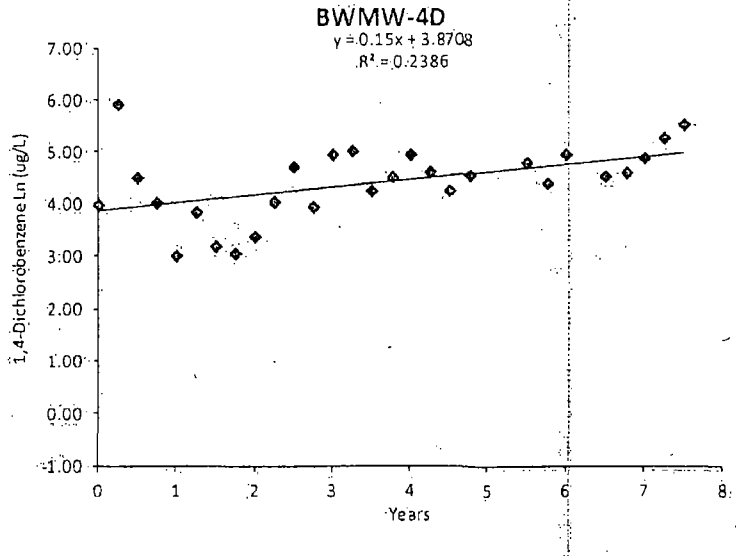

BWMW-3M
y = -0.3629x + 5.2172
R² = 0.3274
1,4-Dichlorobenzene Ln (ug/L)
Years

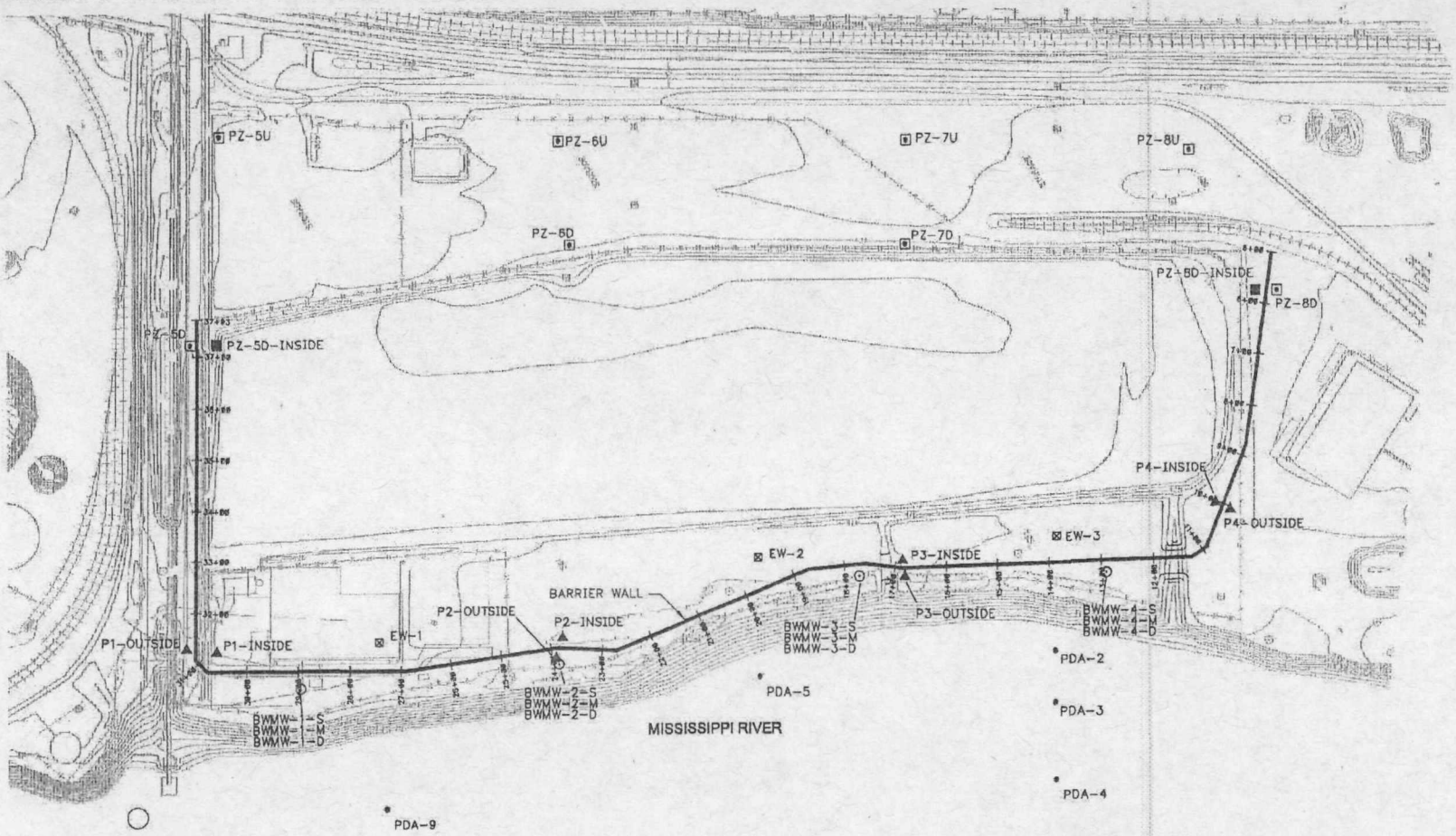

BWMW-4M
y = -0.1187x + 3.6589
R² = 0.2825
1,4-Dichlorobenzene Ln (ug/L)
Years


BWMW-1D
y = -0.0436x + 1.965
R² = 0.1561
1,4-Dichlorobenzene Ln (ug/L)
Years


BWMW-2D
y = 0.1043x + 5.2806
R² = 0.1953
1,4-Dichlorobenzene Ln (ug/L)
Years


BWMW-3D
y = -0.0166x + 4.2611
R² = 0.0042
1,4-Dichlorobenzene Ln (ug/L)
Years


BWMW-4D
y = 0.15x + 3.8708
R² = 0.2386
1,4-Dichlorobenzene Ln (ug/L)
Years



LEGEND

- GROUNDWATER LEVEL PIEZOMETERS
- IMAGE PIEZOMETER (PZ-5D-INSIDE AND PZ-8D-INSIDE)
- EXTRACTION WELLS
- GROUNDWATER LEVEL PIEZOMETERS
- MONITORING WELL CLUSTERS
- SURFACE WATER AND SEDIMENT SAMPLING STATIONS

Ø 200
SCALE FEET

INTERIM OPERATING PERIOD TECH MEMO GROUNDWATER MIGRATION CONTROL SYSTEM SAUGET AREA 2 SAUGET & CAHOKIA, ILLINOIS	PROJECT NO. 21561391.00000
URS	
DRN. BY: djd 11/10/05 DSGN. BY: rel CHKD. BY:	Piezometer and Well Locations
	FIG. NO. 1

ATTACHMENT 2- FIGURES

Figure 1: Site Location

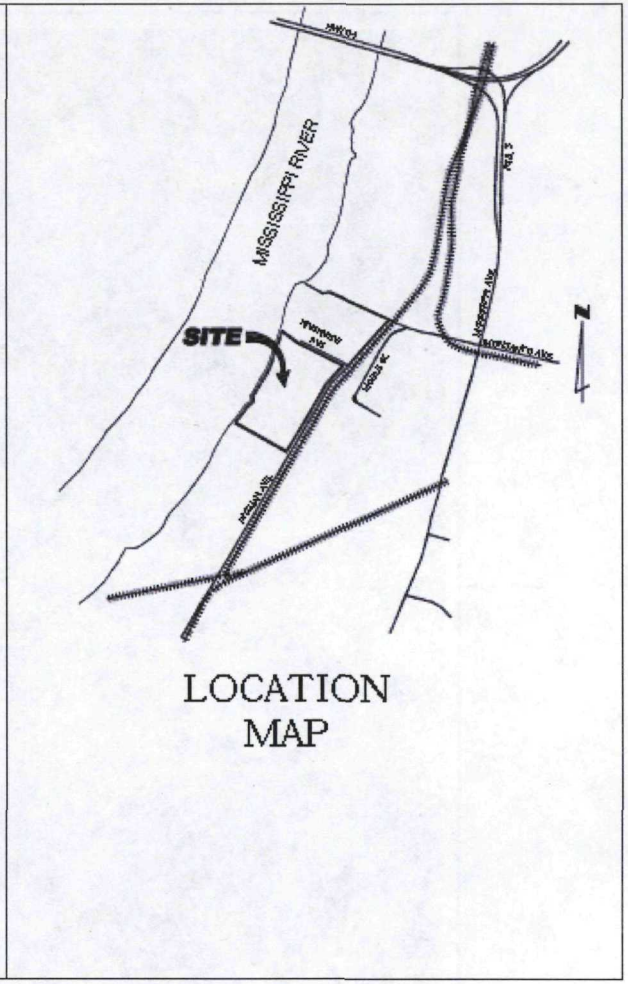


Figure 2: Sauget Area 2 Sites

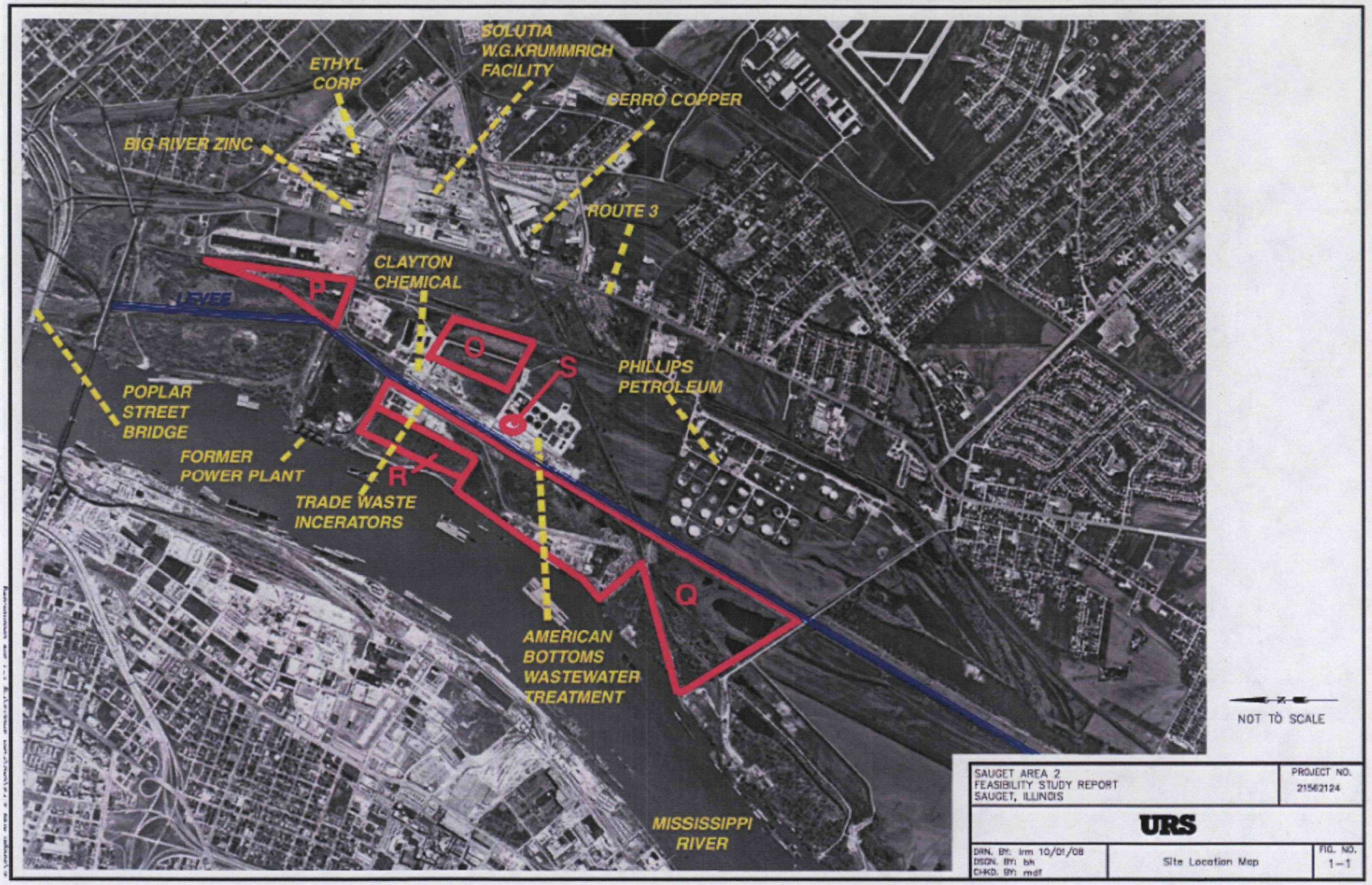
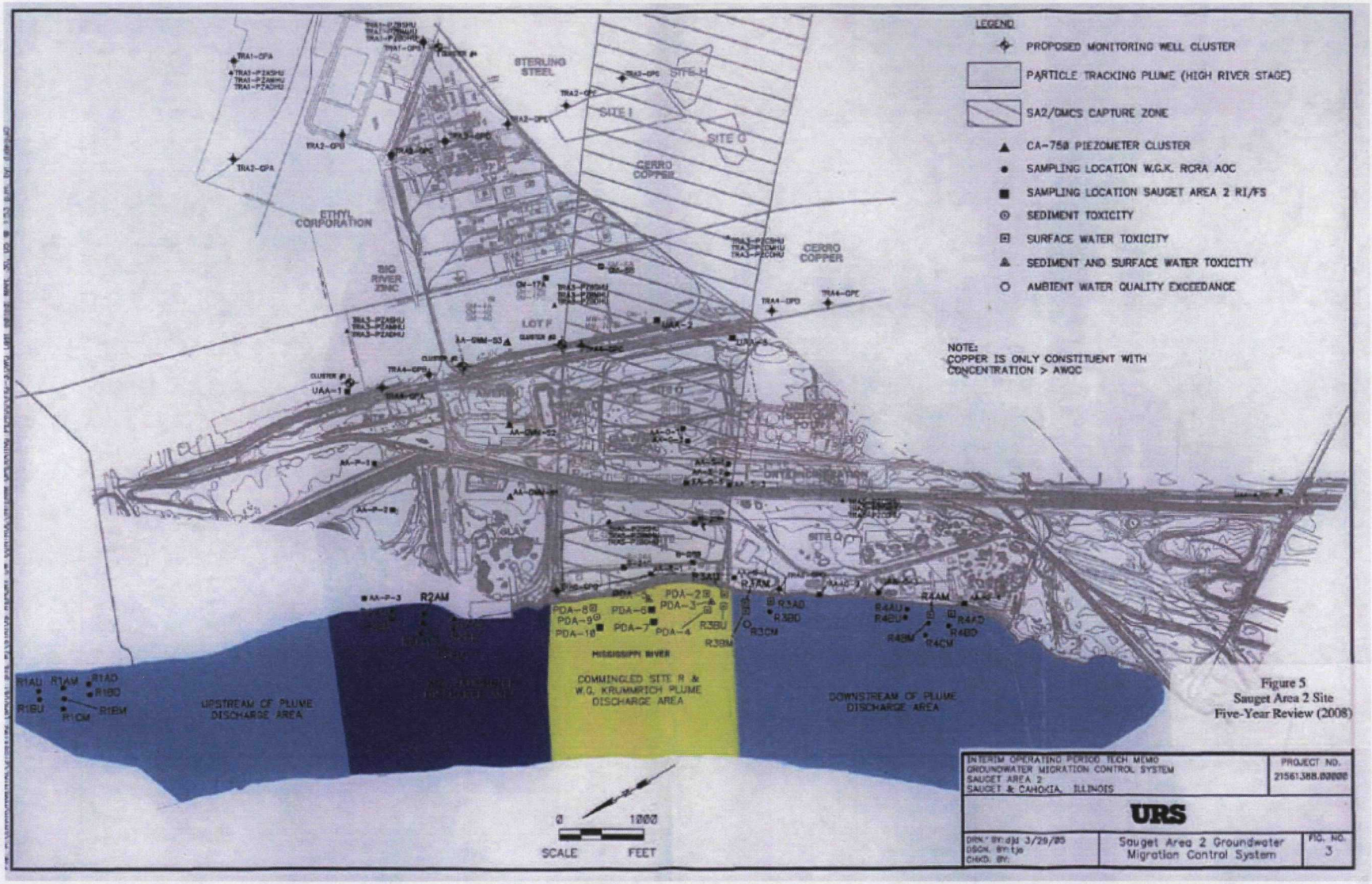


Figure 3: Industrial Areas

Figure 4: Plume Discharge Areas



ATTACHMENT 3- ORDINANCES

ORDINANCE NO. 775

AN ORDINANCE PROHIBITING THE USE OF GROUNDWATER AS A POTABLE WATER SUPPLY BY THE INSTALLATION OR USE OF POTABLE WATER SUPPLY WELLS OR BY ANY OTHER METHOD

WHEREAS, certain properties in the Village of Sauget, Illinois, have been used over a period of time for commercial/industrial purposes; and

WHEREAS, because of said use, concentrations of certain chemical constituents in the groundwater beneath the Village may exceed Class I groundwater quality standards for potable resource groundwater, as set forth in 35 Illinois Administrative Code Part 620, or Tier 1 residential remediation objectives, as set forth in 35 Ill. Adm. Code Part 742; and

WHEREAS, the Village of Sauget desires to limit potential threats to human health from groundwater contamination while facilitating the redevelopment and productive use of properties that are the source of said chemical constituents;

NOW, THEREFORE, BE IT ORDAINED BY THE VILLAGE COUNCIL IN THE VILLAGE OF SAUGET, ILLINOIS:

Section One: Use of groundwater as a potable water supply prohibited.

The use or attempted use of groundwater from within the corporate limits of the Village as a potable water supply by the installation or drilling of wells or by any other method is hereby prohibited.

Section Two: Penalties

Any person violating the provisions of this ordinance shall be subject to a fine of up to $750 for each violation.

Section Three: Definitions.

"Person" is any individual, partnership, co-partnership, firm, company, limited liability company, corporation, association, joint stock company, trust, estate, political subdivision, or any other legal entity, or their representatives, agents or assigns.

"Potable water" is any water used for human or domestic consumption, including, but not limited to, water used for drinking, bathing, swimming, washing dishes, or preparing foods.

Section Four: Repealer.

All ordinances or parts of ordinances in conflict with this ordinance are hereby repealed insofar as they are in conflict with this ordinance.

Section Five: Severablity.

If any provision of this ordinance or its application to any person or under any circumstances is adjudged invalid, such adjudication shall not affect the validity of the ordinance as a whole or of any portion not adjudged invalid.

Section Six: Effective Date.

This ordinance shall be in full force and effect from and after its passage, approval and publication, as required by law.

INTRODUCED AND READ FOR THE FIRST TIME: October 12, 1999

READ FOR THE SECOND TIME:
(under suspension of rules): October 12, 1999

READ FOR THE THIRD TIME:
(under suspension of rules): October 12, 1999

ADOPTED AND ENACTED: October 12, 1999

ROLL CALL VOTE:
Ayes: Adele, McDaniel, Rich, Cates, Thornton, Sauget
Nays: NONE
Absent: NONE
Unfilled Vacancy:

APPROVED: October 12, 1999

APPROVED:

Paul Sauget
President (mayor) Pro Temore

ATTEST:

Betty Jean Wilson
Village Clerk

RECEIVED
FEB 5 1998
IEPA/BOL

East Saint Louis
Illinois

CITY CLERK'S CERTIFICATE

STATE OF ILLINOIS,
ST. CLAIR COUNTY
CITY OF EAST ST. LOUIS, } **I,** Alzada Christian-Carr

CITY CLERK FOR THE CITY OF EAST ST. LOUIS, ILLINOIS, DO HEREBY CERTIFY THAT THE ABOVE AND FOREGOING IS A TRUE AND CORRECT COPY OF

An Ordiance prohibiting the use of Groundwater as a potable water supply; instituted to protect the safety, health and welfare of local residents and provide protective covenants to facilitate the redevelopoment and re-use of property in the City of East St. Louis

PASSED: November 13, 1997 By The Board of Councilmen and Mayor Gordon D. Bush

And I Further Certify That the Original Ordinance

Of Which The Foregoing Is A Certified Copy, Is By Law Intrusted To My Custody For Safe Keeping, And Is On File In My Office.

WITNESS My Hand And The Corporate Seal Of Said City,

This 3rd **Day of** February **A.D. 19** 98

Alzada Christian Carr

City Clerk Of East St. Louis, Illinois

ORDINANCE # 97 -10061

AN ORDINANCE PROHIBITING THE USE OF GROUNDWATER AS A POTABLE WATER SUPPLY; INSTITUTED TO PROTECT THE SAFETY, HEALTH AND WELFARE OF LOCAL RESIDENTS AND PROVIDE PROTECTIVE COVENANTS TO FACILITATE THE REDEVELOPMENT AND RE-USE OF PROPERTY IN THE CITY OF EAST ST. LOUIS.

WHEREAS: the City of East St. Louis, St. Clair County, Illinois (the 'City'), is a duly created, organized and validly existing municipality of the State of Illinois under the 1970 Illinois Constitution (the 'Constitution') and the laws of the State of Illinois, including particularly the Illinois Municipal Code, and all laws amendatory thereof and supplementary thereto (*Chapter 65, Act 5, Illinois Compiled Statutes (1994);* the 'Code'); and

WHEREAS: the City is a 'home rule unit' under Section 6(a) of Article VII of the Constitution and, as such, may exercise any power or perform any function pertaining to its government and affairs including, but not limited to, the power to tax and the power to incur debt, and the power to protect the health and promote the welfare of its citizens; and

WHEREAS: The City of East St. Louis may enter into a Redevelopment Plan and Planed Units Development Agreement that may be made a part of this Ordinance by reference.

Section One. Use of groundwater as a potable supply prohibited.

EXCEPT FOR SUCH USES OR METHODS IN EXISTENCE BEFORE THE EFFECTIVE DATE OF THIS ORDNANCE, The use or an attempt to use as a potable water supply, groundwater from within the corporate limits of the City of East St. Louis by the installation or drilling of wells or by any other methods is hereby prohibited.

Section two. Penalties.

Any person violating the provisions of this ordinance shall be subject to a fine of up to five hundred dollars ($500.00) for each violation.

Section three. Definitions.

"Persons" is any individual, partnership, co-partnership, firm, company, limited liability company, corporation, association, joint stock company, trust, estate, political subdivision, or any entity, or their legal representative, agents or assigns.

"Potable water" is any water used for human or domestic consumption, including, but not limited to, water used for drinking, bathing, swimming, washing dishes, or preparing foods.

Section four. Repealer.

All ordinances or parts of ordinances in conflict with this ordnance are hereby repealed insofar as they are in conflict with this ordinance.

Section five. Severability.

If any provision of this ordinance or its application to any person or under any circumstances is adjudged invalid, such adjudication shall not effect the validity of the ordinance as a whole or any portion not adjudged invalid

Section six. Effective date.

This ordinance shall be in full force and effect upon passage, approval and publication as required by law.

The City Council of the City of East St. Louis herein authorizes the Mayor and or City Manager to implement and sign any and all corresponding and necessary government regulatory documents to implement this "Ground Water Safety and Public Health Protection Ordinance, herein passed; via any and all necessary Memorandum of Understandings (MOU) already passed by City Council or deemed to be

necessary by and between the City of East St. Louis and the appropriate and or necessary Environmental Protection Agencies (i. e. The Illinois Environmental Protection Agency, IEPA; the United States Environmental Protection Agency including U. S. EPA Region V; and or the State of Illinois Department of Natural Resources (DNR), and or appropriate County Agencies and/or the Financial Advisory Authority, including the proper recording and posting of any and all material concerning this Ordinance and those Agreements and Memorandum of Understandings (MOU's) affecting this Ordinance.

BY: Gordon D. Bush

GORDON D. BUSH, MAYOR _____ Date

SIGNED: November 13, 1997

PASSED: November 12, 1997

FILED: _____

RECORDED: _____

ATTEST: Alzada Christian Carr

ALZADA C. CARR, CITY CLERK

Explanatory Statement - Ordinance prohibiting the use of groundwater as a potable water supply (Union Bank Project)

The following is a brief description of why a Groundwater Ordinance is needed, why it has been modified, and where we are with the groundwater problem in Metro-East St. Louis, and specifically at the Union Bank site.

The City has groundwater contamination; any infiltration into the groundwater from specific contaminated soil exacerbate the problem. The state will not allow such conditions to exist for selected contaminates.

The problem. . . when the City seeks to redevelop and reuse its commercial and industrial sites, odds are some form of contaminate may likely exist. We housed many polluters of yesterday. Keep in mind, even old highway routes from the era of leaded automotive gasoline users, spewing contaminates onto the ground adjacent and along the right-of-way. This oftentimes resulted in *(Lead contaminated sites).*

Other sites in our City may actually have been leaden with night dumping and manufacturers who processed products no longer tolerable. To reuse this land, *'someone'* must comply with all federal, state and local regulations pertaining to <u>any contaminates</u> above Tier I level, if the site is to be reused and/or revitalized in accordance with current law.

The mechanism available in the State of Illinois for site remediation/reuse and redevelopment of Brownfields where actual contaminates exist, is to comply with the <u>State of Illinois EPA Voluntary Clean-up Program</u> and site remediation. This is the process the City selected, the re-utilization of the Union Bank Drive-up/Office Complex site. The guidelines call for several safeguards: Clean up and removal of contaminates; engineered barrier, mechanisms put in place to prevent any further contamination; institutional controls, etc.

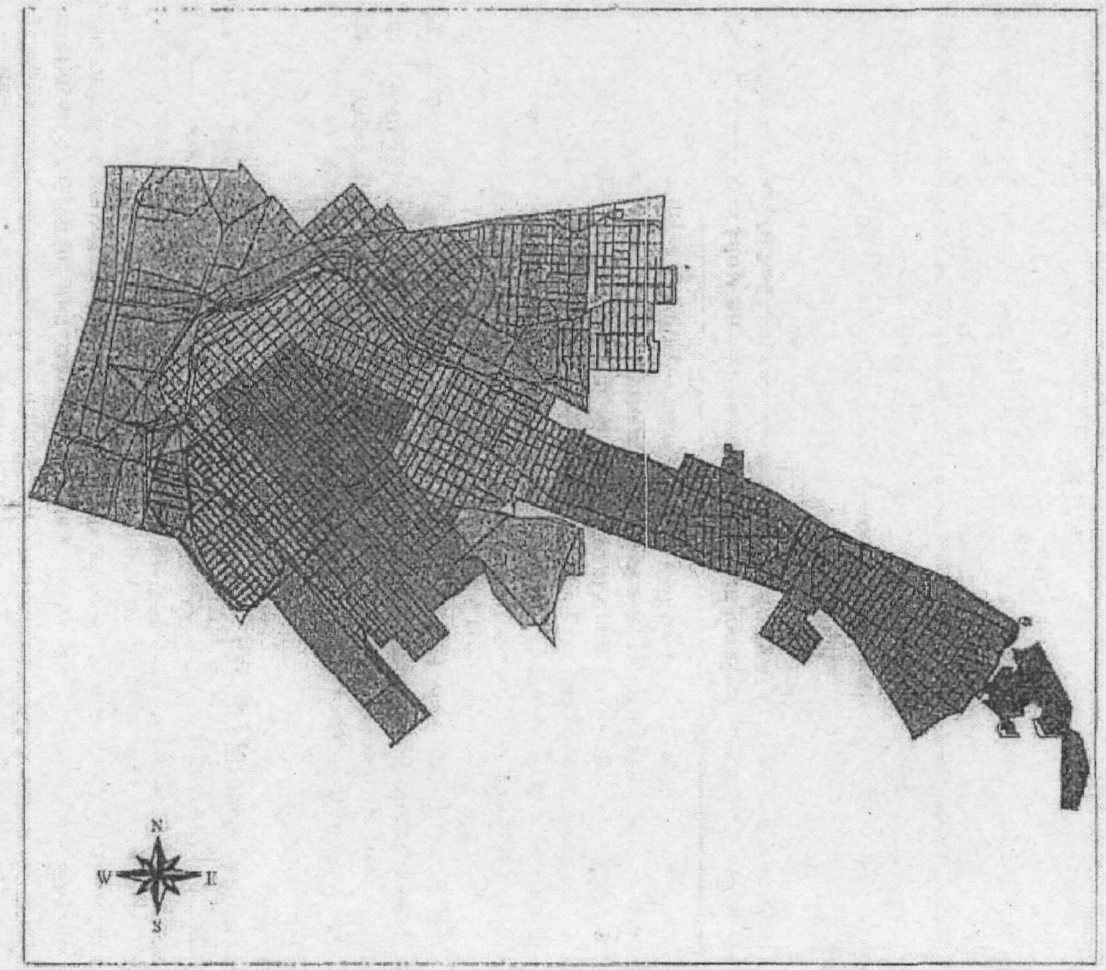
This Groundwater Ordinance is an Institutional Control required by the IEPA. It was approved by our City Council in the form IEPA dictated and required verbatim. However, another important IEPA entity made revisions, that he said is also required.

Terry Bruckert, of Hinshaw and Culbertson, revised the first 'Ordinance' that was approved by Council. Also, he has reviewed the attached Ordinance, as well as the one for CH2MHill. I don't recommend we do anything to the first Ordinance that has already been passed. If in conflict, which it isn't, there is a repealer clause in it.

Once this Ordinance is passed, we will need the Memorandum of Understanding (MOU) by and between the IEPA and the City of East St. Louis. I have suggested it be in a Planned Units Development (PUD) for the Union Bank development, in order to cover the process properly.

City of East St. Louis

City Boundary Map



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Prepared
by
CDBG Operations Corporation

June 1998

MEMORANDUM OF UNDERSTANDING BETWEEN CITY OF E. ST. LOUIS, IL. AND THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY REGARDING THE USE OF A LOCAL GROUNDWATER OR WATER WELL ORDINANCE AS AN ENVIRONMENTAL INSTITUTIONAL CONTROL

I. PURPOSE AND INTENT

A. This Memorandum of Understanding ("MOU") between CITY OF E. ST. LOUIS, IL. and the Illinois Environmental Protection Agency ("Illinois EPA") is entered into for the purpose of satisfying the requirements of 35 Ill. Adm. Code 742.1015 for the use of groundwater or water well ordinances as environmental institutional controls. The Illinois EPA has reviewed the groundwater or water well ordinance of the City of EAST ST. LOUIS, IL. (Attachment A) and determined that the ordinance prohibits the use of groundwater for potable purposes and/or the installation and use of new potable water supply wells by private entities but does not expressly prohibit those activities by the unit of local government itself. In such cases, 35 Ill. Adm. Code 742.1015(a) provides that the unit of local government may enter into an MOU with the Illinois EPA to allow the use of the ordinance as an institutional control.

B. The intent of this Memorandum of Understanding is to specify the responsibilities that must be assumed by the unit of local government to satisfy the requirements for MOUs as set forth at 35 Ill. Adm. Code 742.1015(i).

II. DECLARATIONS AND ASSUMPTION OF RESPONSIBILITY

In order to ensure the long-term integrity of the groundwater or water well ordinance as an environmental institutional control and that risk to human health and the environment from contamination left in place in reliance on the groundwater or water well ordinance is effectively managed, EAST SAINT LOUIS hereby assumes the following responsibilities pursuant to 35 Ill. Adm. Code 742.1015(i):

A. EAST SAINT LOUIS will notify the Illinois EPA Bureau of Land of any proposed ordinance changes or requests for variance at least 30 days prior to the date the local government is scheduled to take action on the proposed change or request (35 Ill. Adm. Code 742.1015(i)(4));

B. EAST SAINT LOUIS will maintain a registry of all sites within its corporate limits that have received "No Further Remediation" determinations from the Illinois EPA (35 Ill. Adm. Code 742.1015(i)(5));

C. EAST SAINT LOUIS will review the registry of sites established under paragraph II. B. prior to siting public potable water supply wells within the area covered

RELEASABLE

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REVIEWER MM

by the ordinance (35 Ill. Adm. Code 742.1015(i)(6)(A));

D. EAST SAINT LOUIS will determine whether the potential source of potable water has been or may be affected by contamination left in place at the sites tracked and reviewed under paragraphs II. B. and C. (35 Ill. Adm. Code 742.1015(i)(6)(B)); and

E. EAST SAINT LOUIS will take action as necessary to ensure that the potential source of potable water is protected from contamination or treated before it is used as a potable water supply (35 Ill. Adm. Code 742.1015(i)(6)(C)).

NOTE: Notification under paragraph II. A. above or other communications concerning this MOU should be directed to:

Manager, Division of Remediation Management
Bureau of Land
Illinois Environmental Protection Agency
P.O. Box 19276
Springfield, IL 62794-9276

III. SUPPORTING DOCUMENTATION

The following documentation is required by 35 Ill. Adm. Code 742.1015(i) and is attached to this MOU:

A. Attachment A: A copy of the groundwater or water well ordinance certified by the city clerk or other official as the current, controlling law (35 Ill. Adm. Code 742.1015(i)(3));

B. Attachment B: Identification of the legal boundaries within which the ordinance is applicable (certification by city clerk or other official that the ordinance is applicable everywhere within the corporate limits; if ordinance is not applicable throughout the entire city or village, legal description and map of area showing sufficient detail to determine where ordinance is applicable) (35 Ill. Adm. Code 742.1015(i)(2));

C. Attachment C: A statement of the authority of the unit of local government to enter into the MOU (council resolution, code of ordinances, inherent powers of mayor or other official signing MOU – attach copies) (35 Ill. Adm. Code 742.1015(i)(1)).

IN WITNESS WHEREOF, the lawful representatives of the parties have caused this MOU to be signed as follows:

FOR: CITY OF EAST SAINT LOUIS, ILLINOIS
(Name of city or village)

ATTACHMENT 4- PUBLIC AD NOTICE

Obama plays tourist after diplomatic chores completed

BY LESLEY CLARK
McClatchy Newspapers

PETRA, Jordan — Content that he laid the groundwork for possible improvements in the Middle East, President Barack Obama played tourist Saturday, gazing at the wonder of the ancient city of Petra on his last stop of a four-day trip to the Mideast.

As he did, he left behind some signs of change in the region, most notably a potential rapprochement between Israel and Turkey. He also left a push to restart Israeli-Palestinian peace talks with Secretary of State John Kerry staying behind to huddle with the principals, and a much warmer relationship with Israeli Prime Minister Benjamin Netanyahu that could lead to a more united front in standing up to Iran's push to develop a nuclear weapon.

None of it suggested any dramatic turnarounds. His close embrace of Israel angered some Palestinians. But things looked different when he left, and Obama appeared to have had a successful first trip abroad in his second term.

After days of talks with leaders in one of the most fractious regions of the world, Obama appeared content to let someone else do the talking Saturday at Petra. He walked down the dusty stone corridor between sheer red rock, listening as his private tour guide pointed out the features of Petra, Jordan's most popular tourist attraction.

"This is pretty spectacular," he said as he looked at Al-Khazneh, or The Treasury, a facade carved into a limestone cliff and the best preserved of all the facades and carvings in Petra. It is believed to have been carved as a tomb for a king in the century before Christ.

Associated Press

President Barack Obama visited the ancient city of Petra after the diplomatic work was done.

White House officials billed the visit — the last stop on a tour that took him to Israel and the West Bank before Jordan — as recognition of the "importance of Petra to Jordan and the ancient history of the Middle East." Many of the facades in the city were carved into sheer mountain rock face by the Nabataeans, who made Petra an important junction for trade routes linking China, India and southern Arabia with Egypt, Syria, Greece and Rome.

A University of Jordan tourism professor led Obama on a tour down the narrow gorge called The Siq, delivering a steady stream of details about Petra and rarely stopping to take a breath. Obama, casual in a navy windbreaker, khaki pants and sunglasses, nodded, and took in the scenery.

White House officials appeared buoyed by the trip — Obama's first to the region since the Arab Spring.

His most notable achievement was brokering the start of a reconciliation between Israel and Turkey. After months of prodding, Obama watched as Netanyahu apologized to Turkish Prime Minister Recep Tayyip Erdogan for a 2010 Israeli attack on a ship nearing Gaza that killed nine Turkish nationals.

The phone call, made from a trailer on an Israeli airport tarmac as Obama was about to leave Israel, started to repair relations between the Israel and a major Muslim country, both U.S. allies.

Obama also pushed for Israelis and Palestinians to work anew toward peace. He offered no U.S. blueprint, but dropped his insistence that Israel stop building housing settlements in the West Bank as a precondition to talks. Kerry was holding meetings Saturday evening with Netanyahu and Palestinian Authority President Mahmoud Abbas.

While the trip made progress, only time will tell if the White House will pursue peace talks, said Aaron David Miller, a vice president at the Woodrow Wilson International Center for Scholars and a former adviser to Democratic and Republican secretaries of state.

EPA Begins Review of Sauget Area 2 Superfund Site
Sauget, Illinois

The U.S. Environmental Protection Agency is conducting a five-year review of the Sauget Area 2 Superfund site located on the eastern side of the Mississippi River, bordered by the city of East St. Louis and the villages of Cahokia and Sauget, Illinois. The Superfund law requires regular checkups of sites that have been cleaned up – with waste managed on-site – to make sure the cleanup continues to protect people and the environment.

EPA's cleanup tackled the release of contaminated underground water (ground water) to the Mississippi River near an area known as Site R. The cleanup consisted of a 140-foot deep barrier wall and a ground water extraction system. Together, the extraction wells are removing contaminated water and the barrier wall is stopping the flow of contaminants to the Mississippi River. Ground water is treated off-site before discharging to the river. Ground water, sediment (mud) and surface water are being monitored for contamination. The review should be completed this August.

More information is available at the Cahokia Public Library, 140 Cahokia Park Drive and at www.epa.gov/region5cleanup/saugetarea2. The five-year review is an opportunity for you to tell EPA about site conditions and any concerns you have. You may contact:

Stephanie Linebaugh
Remedial Project Manager
312-353-2315
linebaugh.stephanie@epa.gov

Patricia Krause
Community Involvement Coordinator
312-886-9506
krause.patricia@epa.gov

You may call EPA toll-free at 800-621-8431, 8:30 a.m. to 4:30 p.m., weekdays

ATTACHMENT 5- SITE INSPECTION CHECKLIST

Site Inspection Checklist

I. SITE INFORMATION

Site name: Sauget Area 2 – Site R	**Date of inspection: June 13, 2013**
Location and Region: Sauget, IL / R5	**EPA ID: 05XX**
Agency, office, or company leading the five-year review: EPA, Region 5	**Weather/temperature:**

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☐ Institutional controls
- X Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other_____
- ☐ Monitored natural attenuation
- X Groundwater containment
- X Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __Steve Smith_____ _Director, Remedial Projects __6/13/2013_
   Name Title Date
   Interviewed X at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed X at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

   Agency ___Illinois EPA_____
   Contact ___Paul Lake_____ __Project Mgr __ __6/13/2013_____
   Name Title Date Phone no.
   Problems; suggestions; G Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - X O&M manual — X Readily available — X Up to date — ☐ N/A
   - X As-built drawings — X Readily available — ☐ Up to date — X N/A
   - X Maintenance logs — X Readily available — X Up to date — ☐ N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — X Readily available — ☐ Up to date — ☐ N/A
   - X Contingency plan/emergency response plan — X Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — X N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — X N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — X N/A
   - X Waste disposal, POTW — X Readily available — X Up to date — ☐ N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — X N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — X N/A

   Remarks_____

7. **Groundwater Monitoring Records** — X Readily available — X Up to date — ☐ N/A

   Remarks_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — X N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — X N/A
   - X Water (effluent) — X Readily available — X Up to date — ☐ N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — X N/A

    Remarks__The Site is fenced and locked and not normally manned.

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house X Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____

2. **O&M Cost Records**

☐ Readily available X Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS X Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** X Location shown on site map X Gates secured ☐ N/A
Remarks_____

B. Other Access Restrictions

1. X **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No X N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No X N/A

Type of monitoring (*e.g.*, self-reporting, drive by) __In accordance with O & M Plan_____
Frequency _____ In accordance with O & M Plan _____
Responsible party/agency __Responsible Parties_____
Contact ___Steve Smith_____ __Director , Remedial Projects__ 6/13/2013 314-674-4660
Name Title Date Phone no.

Reporting is up-to-date X Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met X Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No X N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** X ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map X No vandalism evident
Remarks

2. **Land use changes on site** X N/A
Remarks

3. **Land use changes off site** X N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads X Applicable ☐ N/A

1. **Roads damaged** X Location shown on site map X Roads adequate ☐ N/A
Remarks

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS ☐ Applicable X N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Cracks** ☐ Location shown on site map G Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** X Grass X Cover properly established X No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks__Spoils from slurry wall construction stockpiled onlandfill and covered with HDPE liner and riprap on slopes._____

7. **Bulges** ☐ Location shown on site map X Bulges not evident
   Areal extent_____ Height_____
   Remarks_____

8. **Wet Areas/Water Damage** X Wet areas/water damage not evident

☐ Wet areas ☐Location shown on site map Areal extent_____

☐ Ponding ☐ Location shown on site map Areal extent_____

☐ Seeps ☐Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map X No evidence of slope instability

Areal extent_____

Remarks_____

B. Benches ☐ Applicable X N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay

Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay

Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay

Remarks_____

C. Letdown Channels ☐ Applicable X N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement

Areal extent_____ Depth_____

Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation

Material type_____ Areal extent_____

Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion

Areal extent_____ Depth_____

Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ G No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations X Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked G Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
X Properly secured/locked X Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked G Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐Needs Maintenance ☐ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____

E. Gas Collection and Treatment ☐Applicable X N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition G Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition G Needs Maintenance ☐ N/A
   Remarks_____

F. Cover Drainage Layer ☐ Applicable X N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable X N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable x N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge x Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map x Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   x Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map x Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☐ Functioning x N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS x Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map x Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring__Groundwater, surface water and sediments_____
   ☐ Performance not monitored
   Frequency__In accordance with O&M Plan_____ ☐ Evidence of breaching
   Head differential__Varies with riverstage_____
   Remarks_____

C. Treatment System ☐ Applicable X N/A

1. **Treatment Train** (Check components that apply)
   - ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☐ Air stripping ☐ Carbon adsorbers
   - ☐ Filters_____
   - ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   - ☐ Others_____
   - ☐ Good condition ☐ Needs Maintenance
   - ☐ Sampling ports properly marked and functional
   - ☐ Sampling/maintenance log displayed and up to date
   - ☐ Equipment properly identified
   - ☐ Quantity of groundwater treated annually_____
   - ☐ Quantity of surface water treated annually_____

   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   - ☐ N/A ☐ Good condition ☐ Needs Maintenance

   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   - ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

   Remarks_____

4. **Discharge Structure and Appurtenances**
   - ☐ N/A ☐ Good condition ☐ Needs Maintenance

   Remarks_____

5. **Treatment Building(s)**
   - ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☐ Chemicals and equipment properly stored

   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   - ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   - ☐ All required wells located ☐ Needs Maintenance ☐ N/A

   Remarks_____

D. Monitoring Data

1. Monitoring Data
   - X Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:
   - X Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance x N/A
   Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The objective of the barrier wall is to pump out water naturally going into the barrier wall, for off-site treatment at the local POTW. This is being met. Surface sampling in the Mississippi River has demonstrated that the barrier wall is effectively capturing the groundwater plume.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The GMCS has a good on-line history.

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs,that suggest that the protectiveness of the remedy may be compromised in the future. None.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None.